The Dock and Harbour Authority

No. 265. Vol. XXIII. Edited by BRYSSON CUNNINGHAM, D.Sc. B.E., F.R.S.E., M.Inst.C.E. NOVEMBER, 1942

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Editorial Comments

The Portland Centenary.

If our readers were disposed to adopt a captious or pedantic attitude, they might quite justifiably protest that the heading of this comment and the title of this month's leading article are not strictly correct. The settlement which was the foundation of Portland in the State of Oregon, U.S.A. (it must not be confused with the town of the same name, but of smaller size in the State of Maine) was not actually systematically laid out until 1845, and it did not become a city until six years later, so that based on either of these dates, the centenary lies several years ahead.

But it is our rejoinder and contention that in 1841, as recorded in the article, there occurred an event the significance of which in regard to the city's destiny is of greater importance than the mere location of a habitation, for on May 9th of that year there was launched from Swan Island in the Willamette River, a schooner named " Star of Oregon " which was the forerunner of a great fleet of vessels to be built on the banks of the river and destined to make Portland (Ore.), famous as a great American shipbuilding centre.

The account of the maiden voyage of this vessel, on its hazardous course of over a thousand miles, along a rocky, unchartered coast, bears witness to the sturdy character and determination of the pioneers of the settlement. Since that achievement many wooden and steel ships have been built and have sailed out by way of the Columbia River into the wide Pacific and linked up the trade of Portland with the ports of the world. We have no recent particulars, but it can easily be imagined that the city is playing its full part in the creation of the vast mercantile navy now constructively in hand in the United States for the rescue of civilisation and freedom from the hands of the ruthless gangsterdom which dominates the unfortunate countries of Europe.

It is rather curious to note the ubiquity of the name Portland, especially in a maritime environment. We have alluded to two notable ports of the name in the United States and there is, of course, the great naval base similarly designated in this country, probably the original. or, at least, the inspiration of the others. In addition, there are no fewer than eighteen Portlands scattered in various localities throughout the United States, most, if not all, in association with a sea, lake or river frontage, and there are representatives of the name in New Brunswick and Victoria.

The diffusion of the name does not, however, detract from the importance of its best-known, or all but best-known, bearer.

Dockside Thefts.

From the constant succession of Police Court proceedings against offenders it would appear that far from being stamped out, or even checked, pilferage and theft at the ports of this country are continuing on an increasing scale. In a recent case at Liverpool, a dock labourer was sentenced to three months imprisonment with hard labour for thieving in a wholesale manner over a long period. Two other men were convicted at the same time for similar thefts, or for receiving stolen goods—in one of the cases, 103 fountain pens and 2,400 cigarettes, all destined for the American Forces in this country.

In pronouncing the punishments, the magistrate said: " There is far too much stealing going on at the docks," and indeed it is fairly obvious that among so many reported cases, there must be a considerable number of others in which the delinquents escape detection. It is difficult to know how to deal with an evil so widespread, but a great part of the trouble can be assigned to a body of disreputable individuals in the background who receive and dispose of the purloined property. If these culprits could be traced and their activities suppressed, there would be a decided improvement. This is a task, however, which will call for all the energy and resourcefulness of the police force.

The matter is so insistent and urgent, that it gave rise to a question in the House of Commons. The Minister of War Transport was asked whether he could make any statement on the prevalence of thefts at the Liverpool Docks and the steps taken to prevent them. In reply, the Parliamentary Secretary, Mr. Noel-Baker, said: " No complete or comparable statistics of thefts in the Liverpool Docks are available. I am afraid, however, that at Liverpool, as elsewhere, the number of thefts has undoubtedly increased since the war began. The increase is due in part to the black-out, to the shortage of packing materials and to the consequent difficulties of ensuring adequate supervision; the large profit to be made in the Black

Editorial Comments—continued

Market has also been an important factor. Vigorous measures to check the abuse have been taken with the help of all the authorities at Liverpool and firms concerned; the police have given special attention to the matter and have secured a number of convictions. Many persons besides dock workers have been involved, but 414 dock workers who have been guilty of theft have been dismissed."

It may be suggested that dock workers who are dismissed for such a reason, might well, assuming physical fitness, be conscripted into the army, where military discipline should prove an effective deterrent to the exercise of their nefarious practices.

The Gambling Evil.

Another insidious evil at some ports is gambling and in this connection a number of convictions have been registered at Liverpool against dock labourers. It appears that there has been an organised gang for encouraging, during the dinner hour, the game known as " pitch and toss." Many complaints have been received by the police in reference to the operations of this gang. One letter stated that a workman off a certain ship had lost £42 and another that the wife of one of the labourers had come down to intercept her husband and " fight " him for his wages, having had none for two weeks, though she had four children to keep.

Such a state of affairs is far from satisfactory and cannot be regarded with complacency, though at the same time it would be unwise to accept these isolated cases as typical of the conduct of dock labour as a class, the great majority of the men being honest and industrious, as records of their performances show.

Fire Ladders in Dock Work.

The liability of quayside buildings of the multi-storeyed or warehouse type, often packed with perishable and inflammable goods to great heights, to the disastrous consequences of a sudden outbreak of fire, especially under the conditions of aerial attack, render precautionary measures by port authorities of the utmost importance.

Every means of combatting an outbreak should receive careful consideration, and, not least, the provision of fire ladders of extensive range, both for the handling of hose and as a means of escape for persons entrapped in the upper floors of lofty buildings.

The article in this issue is descriptive of the latest type of steel telescopic, power-operated ladders. The difficulty of obtaining access to the upper floors of lofty warehouses can be seen from the photographic illustration accompanying the article and it is obvious that in the case of wooden ladders, which, even if able to command the upper storeys, are thereby exposed to flame and heat from the lower windows and door openings, there is serious risk of breakdown and collapse.

The Port of Rosario and its Administration.

As from October 16th, a change has taken place in the administration of the Argentine port of Rosario. On that date, in accordance with the terms of the agreement with the Port of Rosario Company, when the port was constructed 40 years ago, it passed into the hands of the National Government. Local opinion, as reflected in *The Times of Argentina* is, apparently, overwhelmingly in favour of local autonomy, with the formation of a Board of Harbour Commissioners to manage the port, and there is considerable opposition to the alternative arrangement, under which following the example of Buenos Aires, there would be Customs Control, the unfortunate outcome of which was the subject of comment in our September issue. On the two American Continents, politics have an unfortunate habit of intruding into port affairs, and with the experience of Buenos Aires before them, the citizens of Rosario will be well advised to keep their port business entirely separate from the cross currents of feeling engendered by party strife.

The decision of President Catsillo on the future administration of the port will be awaited with interest by the shipping community in Great Britain, as also those of other nationalities trading with South America. Much, of course, depends on the composition of the proposed harbour board which may be expected to include representatives of both shipping and railway interests, in addition to certain government nominees.

The Merseyside Enquiry.

Since our last issue, the official enquiry into the working of the Merseyside Dock Labour Scheme has been held. It lasted over a period of ten days from the 30th September to the 9th October, and at the conclusion of the taking of a volume of evidence from all parties, Sir John Forster, who conducted the enquiry, returned to London to prepare his report, which so far as is known at the time of writing, has not yet been handed in to the Government. As a matter of fact, it seems doubtful whether the findings will be made public.

The issue has, unfortunately, been given a personal turn by the dramatic resignation, on the eve of the enquiry, of Mr. J. Gibson Jarvie, the Regional Port Director. In a statement to the press, Mr. Jarvie declared that he objected to an investigation of his administration as the result of an anonymous press communication. This was a misconception on the part of Mr. Jarvie, made clear in the House of Commons by Mr. Noel-Baker, who specifically denied that the enquiry was due to any anonymous or other communication to the press, and paid a warm tribute to Mr. Jarvie's services. The resignation was, thereupon, withdrawn, but in the meantime, Mr. Robert Letch, Regional Port Director for Scottish ports, had been appointed to fill the vacancy on Merseyside.

Sea-going Hopper Dredgers.

The Paper on Sea-going Hopper Dredgers, a first instalment of which is published in this month's issue, is by a distinguished American engineer—Lieut.-Col. H. B. Vaughan, Jnr.—who has been closely associated with dredger design and operation from as far back as 1915, when he had his first experience at Dismal Swamp (depressing name!) in connection with a scheme of water supply to the Town of Portsmouth in the State of Virginia, U.S.A. Coming to more recent times, he has been engaged in the service of the U.S. Army Corps of Engineers (to which he became attached in 1918) on various dredging undertakings from 1930 onwards, and in 1937, he took charge of design for new craft and supervision of maintenance of all floating plant in the Engineering Department. Since 1940, he has been District Engineer at Philadelphia, having under his control a fleet of 11 sea-going hopper dredgers and 5 pipe-line dredgers.

From this slight sketch of his professional career it will be seen that no one is more competent than Col. Vaughan to discuss the design of dredging plant in United States waters, and his observations on dredger construction there cannot fail to interest and instruct those of our readers who have to deal with dredging problems on this side of the Atlantic, perhaps not exactly under the same conditions, but in circumstances not widely dissimilar.

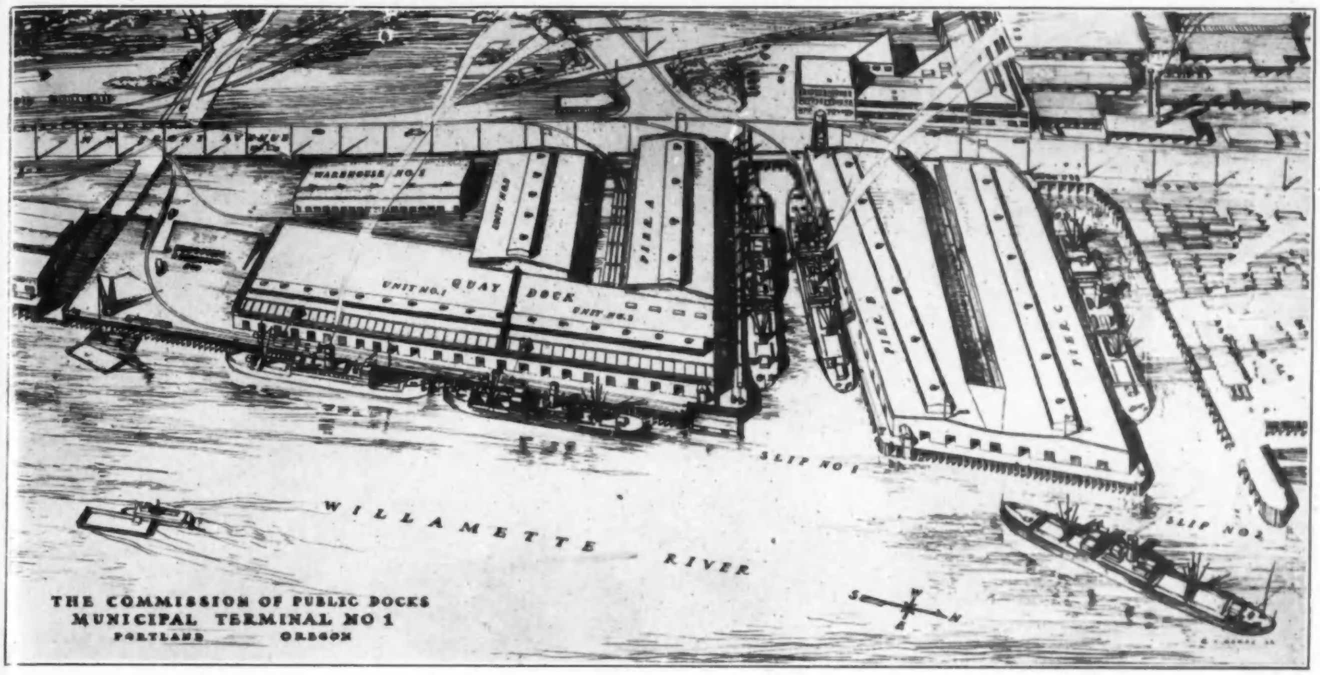
Liverpool Quayside Traffic Arrangements.

In the House of Commons recently the Parliamentary Secretary to the Ministry of War Transport was asked what arrangements had been made between his Department and the Mersey Docks and Harbour Board and railway companies, in respect to the Ministry of War Transport giving increased frontal dock road facilities in Liverpool and to what extent he contemplated closing the Liverpool Overhead Railway; and what consultations he had with the local Carters' and Motormen's Union.

In a written reply Mr. Noel-Baker stated: As a result of interim recommendations made by a Committee under the chairmanship of the Regional Transport Commissioner, certain improvements of railway connections to the Liverpool Docks had been made and the establishment of parking places for road vehicles was under consideration. The committee did not propose that the Liverpool Overhead Railway should be closed.

Publishers' Note.

Under ordinary circumstances the present issue (No. 265) would have marked the commencement of a new volume. The enforced reduction in page size, however, necessitated the premature closing, six months ago, of Vol. xxii., so as to facilitate binding arrangements. It is proposed to complete the normal 12 issues for Vol. xxiii., dating from May last.



The Centenary of Portland, Oregon, U.S.A.

Development of the City and Port, 1841—1941*

Historical

EVER since the discovery of the Columbia, great river of the West, on May 7th, 1792, by Capt. Robert Gray, that stream has borne more and more commercial tonnage between Portland and the Seven Seas.

In October of 1792, Lieut. W. R. Broughton, of the British Navy, sailed 80 miles up the Columbia, but he concluded that " it could hardly be considered as navigable for shipping " and again put to sea.

Meanwhile, Capt. Gray had named the great river after his ship, the *Columbia* and claimed it for the United States. Nineteen years later a trading post had been established at Astoria and the Hudson Bay Company had established a thriving trading settlement at Fort Vancouver, Washington, of which the now famous Dr. McLoughlin was the factor.

The second ship to enter the Columbia was the American brig *Jenny*, and since then a maritime business of vast volume and value has been recorded, with Portland as the metropolitan centre of an ever-growing community of commerce and industry.

Portland's fame as a shipbuilding centre made its start in a very small but significant and historical manner in 1841 with the construction on Swan Island of the 53-ft. schooner *Star of Oregon*. Motive for this pioneer undertaking was the strong desire of early settlers to break the monopoly of the Hudson Bay Company in the livestock field. The plan was to build the vessel, take it to San Francisco and trade it for livestock.

The *Star of Oregon* was a small fore-and-aft vessel, built under most difficult conditions under the aggressive leadership of Joseph Gale, a sturdy mountaineer, but who had been to sea and had also acquired a good knowledge of shipbuilding.

Swan Island, years later destined to become Portland's first airport, was chosen as the building site, and work was started in the fall of 1840. On May 19th, 1841, the *Star of Oregon* was launched. This was before a single tree had been cut to clear the area where the City of Portland later was to stand.

After the launching, the schooner was worked up to Willamette Falls on the Willamette River at Oregon City, where she was given final fittings before putting to sea. On August 27th, she left the falls, and on the 29th cast anchor off Fort Vancouver, where she flung to the breeze in a spirit of pioneer bravado a new American flag, presented by Capt. George Wilkes, then in the Columbia River in the course of an exploration trip around the world. Wilkes sympathised with the *Star of Oregon* project and furnished many necessary things to the builders which had been refused by the Hudson Bay Company, and also supplied Gale with his necessary sailing papers.

Later, the new schooner was taken to Fort George (Astoria), where his inexperienced crew members were taught seamanship. The final start on a formidable 1,000-mile ocean voyage along a rocky coast and without chart was made on September 12th, 1841. On board with Gale were four men and one boy, none of whom were able seamen in any sense of the word, but on September 17th, after a stormy run, the *Star of Oregon* passed through the Golden Gate and anchored before the town of Yerba Buena (San Francisco), its owners completing a daring feat such as only the most courageous could accomplish.

The schooner was sold, and in the Spring of 1842 a company of 42 men started north by land driving large numbers of cattle, horses and sheep, arriving in Portland 75 days later with the much-needed livestock and having sustained the loss of but few animals during the tedious journey northward. Thus ended the Hudson Bay Company's cattle monopoly in the Oregon country.

In order to commemorate the building of the *Star of Oregon* and to perpetuate the deeds of its pioneer builders, a marker has been erected with appropriate ceremonies on Swan Island on the hundredth anniversary of the now famous launching.

Since those historic days, numerous wooden and steel ships have been constructed in Portland, and during the first world war the city became famous for this industry.

*Excerpts from the Report of the Portland Commission of Public Docks for year ended 31st December, 1940.

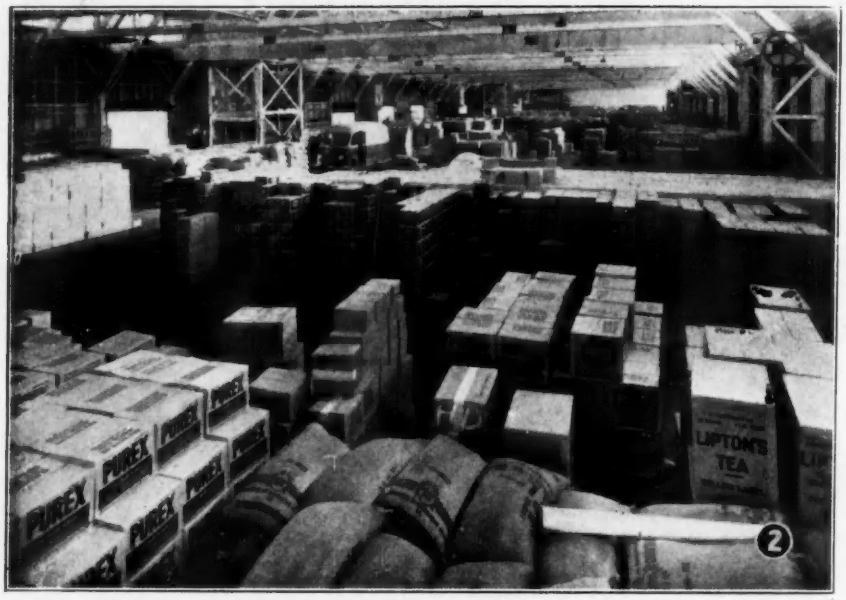
Centenary of Portland, Oregon, U.S.A—continued

Portland has always been fortunate in having courageous and far-sighter leadership to direct and develop its maritime commerce, and from earliest river history its volume steadily increased until to-day it has become a port of major importance.

It required many years of effort to secure the present 35-ft. channel depth, with a minimum width of 500-ft., which Portland now enjoys. Not until the early eighties did Congress appropriate as much as $100,000 for deepening the Columbia River, although the U.S. Engineers began minor channel improvements in 1886. Co-operation between the U.S. Engineers and the Port of Portland has resulted in extensive channel development on the Columbia and Willamette Rivers, which has steadily kept pace with the requirement of the maritime commerce of the port.

Location

Located on the Willamette River a few miles from its confluence with the Columbia, Portland, a city of over 300,000 inhabitants, was incorporated in 1851 and is one of the oldest incorporated communities of the Pacific Northwest.



General Cargo in Shed.

A fresh water harbour, 27 miles of deep water, modern terminal facilities, service by four trans-Continental railroads and 50 odd long and short truck routes combine to make Portland an ideal shipping centre. The Columbia gorge, with its water grade through the Cascade Mountains, makes the city the logical outlet for 200,000 square miles of rich producing area to the East, and the fertile Willamette Valley to the South, with some 11,000 square miles, is likewise naturally tributary to Portland.

Climate

Portland is about 60 miles from the Pacific Ocean in a direct line, and is afforded excellent protection by surrounding hills and mountains, and its climate therefore is equable. It is free from temperature extremes, high velocity winds and destructive storms. The normal annual temperature is 53.1. Normal winter temperature is 40.9, summer 64.3. Normal precipitation is 41.62-in. Wind velocity average is 6.9 miles per hour.

Organisation of the Port

At the election on November 8th, 1910, the voters, by a charter amendment, authorised the creation of the Commission of Public Docks, a separate department of the City. The Commission is administered by a board of five members, who are appointed by the Mayor for terms of five years and who serve without compensation.

Functions of the Commission

The following sub-paragraphs of Section 163 of the Charter indicate some of the more important duties and functions with which the Commission is charged:

(a) To cause to be prepared a comprehensive plan for the reconstruction of the harbour, to provide for the needs of commerce and shipping, the accommodation of water craft of all kinds as well as goods and passengers.

(b) As part of the plan, to provide public-owned docks—number, character and location to be determined by the Commission.

(c) For construction purposes to acquire by condemnation or purchase such lands as may be needed and to lease such portions for industrial purposes as are not necessary for terminals, etc.

(d) To have exclusive control of all wharf property belonging to the City.

(e) To have exclusive control of all privately-owned wharf property of the City.

(f) To call for public proposals and award contracts.

(g) To prepare rules and regulations in the form of ordnances for erection and repair of harbour front structures and to issue permits therefor.

(h) To fix and regulate terminal charges for public-owned facilities.

(i) To use street ends intersecting navigable waters for structures necessary to water-borne commerce.

(j) To employ necessary personnel in the conduct of the Commission's business and to fix compensation for employees.

(k) To make annual itemised report to the Mayor and to levy certain taxes.

Finance

Up to December 31st, 1940, $5,250,200.00 out of a total bonded debt of $10,560,000.00 had been retired, and $674,800.00 of the Commission's own obligations had been acquired and distributed to various sinking funds for future bond redemption. The Commission's actual liability in so far as its outstanding bonds are concerned amounted therefore to $3,236,280.69 at the end of 1940.

Because of legal debt limitations, the Commission can only levy by taxation sufficient sums to meet annually its bonded debt and interest requirements, plus 1/10th of 1 mill of the City's assessed valuation, for general purposes. Thus, it is essential that operating revenues be sufficient to defray all operating expense as well as maintenance, as no tax money is available for these two items. Expenditures for maintenance from 1918 to 1940, inclusive, have averaged $92,819.00 annually, which is approximately 1% of the book value of the Commission's properties. During 1940 a total of $78,725.60 was spent on maintenance.

The 1941 Budget called for a levy of $610,658.00, a sum less than the previous budget by $8,682.00.

Gross operating revenues during a period of thirteen months amounted to $460,445.43, an increase of $17,967.90 over the 1938-39 fiscal year of twelve months. All terminals in 1940 showed an increase in gross operating revenues over 1939 with the exception of Terminal No. 4, which showed a reduction of $21,469.03.

Shipping

A total of 5,249,556 tons of deep-sea shipments moved through the port in 1940, as compared with 5,911,859 tons in the previous year. This drop was in a large measure caused by the war in Europe. Exports of both foreign and domestic fruits, canned goods, lumber, scrap metal, mill feed, vegetable oils, flour, wheat, and wool were among the commodities showing a marked decline. However, imports both foreign and domestic of carpets, coffee,

Centenary of Portland, Oregon, U.S.A.—continued

Pier and Tank Farms of three Petroleum Companies, Portland.

Aerial View of Upper Harbour. Retail Business Section in foreground.

Centenary of Portland, Oregon, U.S.A.—continued

hardwoods, iron and steel products, nuts, oil cake meal, tin and tinplate and wood manufactures showed substantial gains in 1940 over 1939.

The tonnage handled exclusively over the Commission's facilities from December 1st, 1939, to December 31st, 1940, dropped to 627,420 tons from 652,017 tons for the twelve months ending November 30th, 1939.

A new agreement for the cereal year beginning July 1st, 1940, was entered into with the Secretary of Agriculture, whereby the elevator and grain facilities of the Commission at Terminal No. 4 were approved for the storage of wheat eligible for federal loans.

Because many additional storage plants have been recently constructed in the fruit-producing areas, and with the loss of export markets as a result of the war, there was no demand for the Commission's cold and ventilated storage facilities in 1940. Therefore, in line with the practice of recent years, the Commission did not reopen these facilities. Fortunately, however, it was possible to enter into a satisfactory lease with a private operator, who has made extensive improvements and additions to the plant and its equipment.

Because no substantial volume of business was offered, the bunkers for bulk handling at Pier No. 4, were not placed in operation during 1940.

In early October, the government discontinued its subsidy on wheat, which immediately had the effect of curtailing sharply shipments to the Orient. On and after the 16th of October, scrap metal was no longer permitted to be exported without a federal licence. The foregoing action by the Federal Government resulted in a reduced tonnage movement at Terminal No. 4 for the last quarter of the year.

In July, Moore-McCormack initiated a service with the Pacific Republics Line between the Pacific Coast and the East of South America, when the *City of Flint* called at Portland. Shipping circles in Portland were greatly encouraged when, in October the United States Maritime Commission gave its approval to the establishment of a Portland-Orient Service by the American Mail Line. The ss. *Collingsworth*, first vessel in this new service, sailed from Portland on January 12th, 1941.

In the early part of 1940, a serious cargo space shortage threatened the coastwise and intercoastal trades. This was caused by the war demand for tonnage, with its resultant dislocation of established routes due to the sale and chartering of bottoms to more lucrative trades. This Commission joined with the other coast ports and, through the Pacific Coast Association of Port Authorities, they were successful in having H.J.R. 519 (Buck Resolution) passed by Congress, thus permitting the United States Maritime Commission to recondition and place back in service its hundred odd vessels of the laid-up fleet.

Because of the war abroad, services to Europe from this coast have been cancelled or operated on a greatly reduced basis and many of the foreign flag schedules in the trans-Pacific trade have been curtailed or discontinued—resulting in unsettled conditions for operators and shippers alike.

Traffic

Both separately and in conjunction with other groups, especially the Portland Traffic Association, the Commission has continued as heretofore to endeavour to maintain rate schedules and support proposed legislation imicable to the interests of the port and its maritime commerce.

Fire Protection

Three fire boats of modern type, having a capacity of 10,000 gallons per minute, with standard motorised land equipment, including the Jay Stevens disaster car, amply protect the maritime facilities against fire. The patrol boat *Mulkey* and one speedboat, operated under direction of the Harbour Police, provide necessary protection for the water front.

Terminals.

Ocean carriers serving the port find adequate modern facilities at three municipal and many private terminals.

Towage

Available to serve towing requirements of the harbour are various sizes and types of craft operated by private owners, and the Port of Portland's powerful steamer, *Portland* is also on call.

Dry Docks

Two floating docks are operated by the Port of Portland for the repair and overhaul of ships. Floating dock No. 1 is 468-ft. in length and is capable of lifting 10,000 tons deadweight. No. 2 is 492-ft. in length and has a capacity of 15,000 tons. Both are available to all repair contractors at tariff rates.

Discharging Cargo with Ship's Tackle.

Port Authorities

The Commission of Public Docks, a separate department of the city, has jurisdiction over three municipal terminals, which it owns and operates. Water front construction and maintenance with the corporate limits of the city also come under its supervision.

The Port of Portland Commission, members of which are appointed by the Governor, owns and operates two air ports, dredgers, dry docks and a tow boat service. It is also charged with channel maintenance in the harbour area.

Railroads

Four trans-Continental lines serve Portland in addition to local rail lines which connect with its surrounding areas.

Auto Trucks and 'Buses

Portland is connected with all important centres by fleets of modern freight trucks and passenger 'buses, which furnish service, both local and long distance, over the vast network of modern highways radiating from the Oregon metropolis.

(Concluded on page 170)

Hopper dredger "Goethals," in New York Harbour. Largest sea-going hopper dredger in the world.

*Sea-going Hydraulic Hopper Dredgers**

History of their Design, Development and Operation

By Lieut.-Col. H. B. VAUGHAN, Jr., Corps of Engineers, U.S. Army.

Place of Dredgers and Dredging in History

THE seagoing hopper dredger is the culmination of a long and largely unrecorded development of the means by which material is removed from beneath the water surface. The purpose of this paper is to present the history, development, design and operation of this giant tool. Its creation and development were to a large extent made possible by naval architects and marine engineers supplemented by the experience by the U.S. Corps of Engineers.

Much of man's primitive adventures which led to his advancement are lost to us, for the chronicler of events came later than the crude artisan whose acts he recorded.

One of the first manuscripts dealing with dredging, "Architecture Hydraulic," was written by Belidore in 1770. This described a simple method, first ascribed to the Dutch, consisting of a bag and spoon arrangement whereby material was scooped up and placed out of the channel. Another method entailed the boring of holes in a stream bed, the current thereby induced to effect a scour. The "hedgehog" was still another method—a series of wheels, on a common axle, with spikes on their periphery. This device was rolled down the stream by horse power.

Edward Cresy published an encyclopædia of Civil Engineering in 1847, and this volume shows the developments of the ideas narrated in sketchy form by his earlier fellow historians. As an example, the bag and spoon idea was now a fairly well-developed dipper dredger, built on floats, and even housing the crew. Cresy gives descriptions of dredging plant working in Venice and Toulon before the advent of steam and the crude first effort of steam application in England at Sunderland Harbour, Hull, and on the Thames.

Influence on Nations

The effect of man's inventive mind on the rise of a nation has always been a favoured subject. Dredgers and dredging have played no small part in the development of the human family.

Civilisation, for well-known reasons, first developed along streams and waterways. Such places provided the early necessities—water, game attracted by the water; fertile, easily cultivated land, and an easier means of transportation. As the last two needs increased and expanded, ditches had to be dug farther from the stream to irrigate more land; and, later, places in the stream had to be cleared for a low-water movement of boats. Especially was this so when surpluses made barter and finally commerce at greater distances a factor of interest and profit.

Man power—slave hand power—dug the first Egyptian and Mesopotamian irrigation ditches. Man power likewise directed flood waters to limited degrees, dug protecting moats around villages and later around castles, and made landings and berths for canoes, rafts and boats.

When man's physical limitations were reached, he tried to supplement his hands with crude tools—hoes, rakes, ploughs, scoops—and when greater power was needed, he gradually substituted animal power and later mechanical power, until at last steam, Diesel and electrical power are being utilised.

Just what machines the Phoenicians, Greeks, or Carthaginians and Romans used to assist commerce and float war galleys constitute a special and interesting field of research, but crude dredging aided them to become sea powers, and without this sea power a different chapter might have been written in early history.

Venice rose to power through her ships, and the building of this beautiful city on marshes was made possible by dredgers.

The French, while not pioneering so effectively in early dredger development, built the Suez Canal and thereby gained international prestige. They also produced some interesting earth-removing machines which, however, proved ineffective on the Panama Canal. One reason for this failure was their inability to redesign the dredgers to handle harder material than had been encountered in the Suez sands.

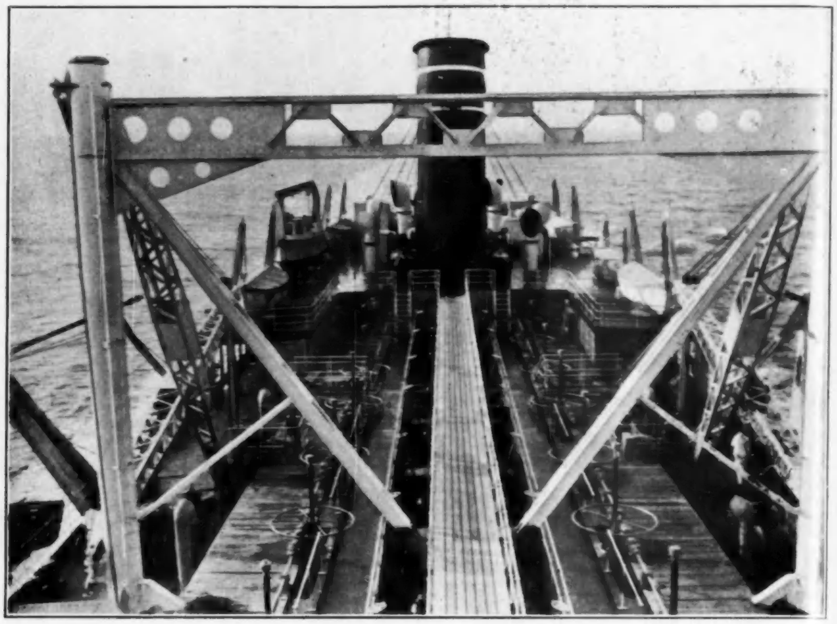
Dredgers and dredging realised for France a system of canals and improved river waterways, connecting practically all cities and towns by means of boats and barges. During the first World War this facility was a real factor in supplementing congested road and railroads.

*Reproduction of Paper read before the Society of Naval Architects and Marine Engineers, New York, U.S.A., in November, 1941.

Sea-going Hydraulic Hopper Dredgers—continued

The history of Holland is, in a way, a history of dredger development. The Dutch were about the first to produce an effective mechanical dredging machine. At an early date they applied dredgers on a national plan in a way so familiar to the world. The seagoing hopper dredgers of Holland were among the best. To their own design were added the developments of other nations. An outstanding feature of one type of their seagoing hopper dredger is the utilisation of propulsion power to operate the dredging pump, by means of a mechanical clutch. In their vast reclamation programme a simple discharge system was designed which permitted spoil to be pumped from hoppers limited distances ashore. Several of these dredgers were brought to the U.S.A. when Galveston Island's grade raising programme in Texas was initiated after the great storm in 1900. Holland's national emblem could well have a dredger in its background.

The world owes much to the Chinese, and that statement is equally true in the field of dredging. Perhaps the greatest hydraulic engineer the world has produced was a Chinaman—certainly the greatest of ancient times, and in recent years, until General H. B. Ferguson, of the Corps of Engineers, succeeded in controlling flood waters on the unruly Mississippi.



Hoppers of the dredger "Goethals," looking aft, showing top of hoppers and gate controls.

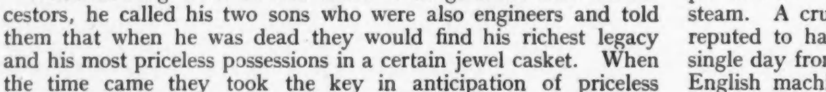
Some three thousand years ago millions of lives were sacrificed in China at irregular intervals due to floods of its great rivers. Li Ping, by his genius, curbed the rivers in his part of that country and as a reward was made its ruler by the grateful people he saved—an unlikely reward for a dredger boatman.

When Li Ping knew he was about to be gathered unto his ancestors, he called his two sons who were also engineers and told them that when he was dead they would find his richest legacy and his most priceless possessions in a certain jewel casket. When the time came they took the key in anticipation of priceless rubies and diamonds. To their ill-concealed disappointment all they found was a sheet of parchment engraved in two vertical lines with Chinese characters. This was Li Ping's priceless secret for flood control, a translation of which reads, "Dig deep, keep banks low."

Evolution of Hydraulic Suction Dredgers

The first mechanical dredgers appeared, according to limited records, early in the 17th century. A Dutch engineer built the *Dieplust* about 1630, at a cost of 100 florins. This floating project carried a pair of troughs whose ends could be depressed by means of a rope, when heaved into the mud bottom, anchored ahead in the stream and operated by a crude windlass. In the troughs an endless rope with boards, a little less in width than the trough, raised the spoil from the bottom of the stream to the top of the trough, whence it fell through the bottom. Wooden gears operated by horses supplied the power from the rear of the dredger. The English improved the type and developed the first power-driven dredger about 1802; this was after the advent of steam. A crude 30 h.p. steam engine supplied the power. It is reputed to have cost £8,000 and to have raised 2,000 tons in a single day from a depth of 30-ft. Shortly after this, another such English machine could, it is recorded, lift 55 tons up "into a spout" in 35 minutes. From this crude idea our present bucket dredgers were evolved, such as are now used in gold dredging and sand and gravel digging, as exemplified by the dredger *Corozal*, which is one of the few of this type now operating which is capable of digging certain rock.

From the idea of slave excavation of sand with bare hands and later with boards fastened to their hands for digging small irrigation canals in Egypt and Asia Minor was born the grab bucket dredger, later developed into the dipper dredger and drag line. This type has been highly developed in the U.S.A. in various interpretations. Long booms, 240-ft. or more, revolving through 360 degs. in certain cases, use special buckets of 5 cub. yds. or more. They are very effective and economical in the handling of soft materials for short distances, or for rehandling in dump scows.



Dredger "Corozal" steel endless chain ladder bucket dredger, 12 to 15 cubic yard buckets. Can dig soft rock.

Early records indicate that sand and soft materials were handled first by being carried in baskets upon the shoulders of slaves or war captives. This was done in the dry and later, water was turned into the waterway by the breaking of an earth dam. The 27-ft. Chesapeake and Delaware Canal, between Chesapeake Bay and Delaware River, was first dug in part by this method, using "contract slave labour." For maintenance of irrigation ditches and canals, dams were made, sections unwatered by crude water wheels, cleaned out by hand and crude tools, and the dams then removed. Gradually, as man's mind became more dredger conscious, horses, oxen or water buffalo replaced man power. Larger drags, rakes, hoes or ploughs were dragged in the streams or from

Sea-going Hydraulic Hopper Dredgers—continued

the banks parallel with the channel, or at various angles with the channel. Possibly here was the first use made of nature's aid in channel deepening, unconscious as it may have been, when the current washed away a certain portion of the spoils. The chief significance of these crude methods was that it was to all intent a positive removal of material on to near banks. Later, this spoil was to be placed in boats or dredgers and involve other means for moving spoil to a desired location.

With the coming of steam, animal power was superseded. Direct methods were still used as exemplified in the bucket and dipper dredgers. Gradually man's needs demanded larger endeavours in steam and waterway excavation when existing methods proved inadequate. Necessity is always the mother of invention. Slowly the suction dredger was evolved. Larger quantities of sand had to be moved to build the Suez Canal. In 1936, a Frenchman by the name of Basin designed a submerged tube producing suction by means of a centrifugal pump. About this same time American engineers invented a similar device, and with customary ingenuity rapidly developed it. No one great name is connected with its evolution. Its development was the product of many practical minds. From the pump barge, handling only " easy come, easy go " material, necessity for meeting special problems produced the spud arrangements for holding the dredger in place and for manœuvring; also the cutter for loosening the material and the ladder for carrying the cutter. Floating and shore discharge lines were also added, so that the dredger's limits for handling hard materials were rapidly pushed back, until toughest clays, compacted sands and cemented gravels now hold no fears for the present suction cutter dredger.

This type of dredger can dig in ordinary material and deposit spoil miles away, if required. The range of the cut of such a dredger was lateral only. Rough weather, mobility and direct longitudinal cutting were factors which could not be satisfactorily surmounted. Once again physical conditions demanded a better special tool to meet economically the ever-increasing demand made for dredgers and dredging. The dictionary implies that " a hopper dredger is a boat that excavates material from the bottom of the waterway, as it moves over a given course, through the process of suction, and deposits the material aboard in bins or hoppers capable of being dumped after having been transported to the desired place, even out to sea if necessary "—a rather complete operation.

Suction dredgers operating in protected places slowly added propelling engines to eliminate tow boats in moving from location to location, but not for digging en route or while under way. A more seaworthy type of hull was demanded for this purpose. Finally a steamship was utilised as the means for carrying the dredging machinery. The first seagoing dredgers were converted wooden hull passenger vessels. The suction pipe was moved to the sides of the boat and a second pump added. As the vessel slowly moved over a prescribed course, the suction pipes were lowered on the bottom by crude ship's tackle and such loose materials as it encountered were pumped into a hopper aboard the vessel. When a satisfactory load was secured, the suction pipes or drags were raised and the boat proceeded under its own power to a dumping ground. The doors on the bottom or sides of the hoppers were opened, the material dumped and the dredger returned to its digging ground to repeat the cycle.

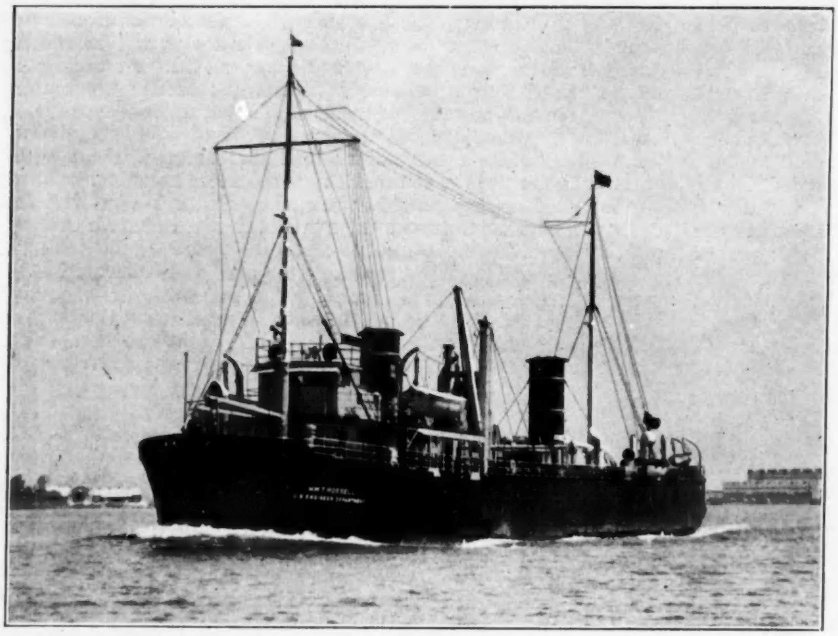
The lower Atlantic seaboard saw the first developments of the seagoing hopper dredger. Probably the first more or less practical one was produced by the Engineer Department in Charleston, S.C., in the early 'fifties, when an old freight steamer, about 150-ft. in length and 67-ft. beam (365 tons), was converted by placing a bin in its hold. This bin was about 15-ft. by 40-ft. at the top, with a 7-ft. by 45-ft. opening in the bottom. As much as something over 60 lbs. of steam was carried on a " high-pressure " boiler. It was seagoing when the sea wasn't too rough. As is still the custom, this seagoing hopper dredger was named after an Army Engineer officer, General Moultrie.

Dredger " New Orleans." Length, overall, 315-ft.; beam, moulded, 50-ft.; depth, moulded, 26-ft.; draft, light, forward, 14-ft. 6-in., aft, 16-ft. 6-in.; draft, loaded, forward, 21-ft. 2-in., aft, 22-ft. 5-in.; displacement (2,240 lb. tons), light, 4700, loaded, 7150.

In about 1875 the United States Government bought a side-wheel passenger steamer, about 132-ft. by 24-ft., drawing approximately 7-ft. A 9-in. centrifugal pump discharged material into a timber bin placed on deck. The bin was provided with side gates through which the mud was washed by pumping clear water when the dredger had passed the outer bar of the Savannah River, where it operated at a snail's pace. It did work, however, in exposed places and that was a definite advance.

No urgent demand was made by commerce for greatly increased depth of channels or harbours on the United States seaboard for a number of years. Along in the late seventies, however, it was increasingly obvious that something must be done to improve the condition of water in the unprotected channels leading to New York Harbour. Two schools of thought developed. One advocated long jetties to quiet the water of Gedney Channel while work was initiated on its deepening. The other group sponsored an ambitious programme—the construction of suitable seagoing hopper dredgers to improve Ambrose Channel. In the meantime, one of the first experiments of any magnitude was made in Gedney Channel in agitation dredging. A contractor attempted to scarify the bottom of the channel with an improvised sea plough towed over a given course, trusting the outgoing tide to carry the loosened spoil to deep water. This experiment did not work so

Sea-going Hydraulic Hopper Dredgers—continued



Dredger "Wm. T. Rossell." Length, overall, 268-ft. 5-in.; beam, moulded, 46-ft.; depth, moulded, 22-ft. 6-in.; draft, light, forward, 14-ft., aft, 15-ft. 3-in.; displacement (2,240 lb. tons), light, 3015, loaded, 5250.

well. Pumps were then used to raise the material and broadcast it on the surface, but the currents still were inadequate. The contractor then built a hopper dredger, probably the first one constructed in its entirety, and finished his first contract of less than one-half million yards at a cost to the Government of 54 cents per yard. The contractor apparently made enough money to encourage him to take a bigger job, and a 30-ft. channel was completed on the sea end of this project at about half the first cost; i.e., 27 cents per yard. While this proved that the dredger could operate in currents and from a bar in rough weather and that the required depth could be maintained without the protection of a jetty, progress was very slow. At the end of the 19th century a channel depth of 40-ft. was needed in the approaches to New York Harbour, and large quantities of material had to be moved quickly or foreign trade would have been seriously handicapped. Time was a factor. The contractor wanted to move the forty odd millions of yards involved at about one-third the former yardage cost. After a few years of slow progress, it was necessary for the Government to take over the work.

Profiting by the experiences gained from their own and contractors' dredgers, the United States Engineer Department, from the first decade in 1900, built many steel hopper dredgers to meet the growing demand of deeper water for shipping. The small wooden and converted hulls were discarded for new ones to house rapidly-improving dredging machinery and equipment.

As the new century advanced, progress continued. Numerous improvements, economies and advancements were made in the design of this type of dredger. Notable among these improvements from the standpoint of design, was the so-called Fruehling type dredger *New Orleans*. This type made use of an idea supplied by Fruehling, a German engineer, of placing a single specially designed draghead at the aft end of the hull with the suction pipe in a stern well. In 1925, four Diesel-electric dredgers of medium capacity (1,500 cubic yds.) were built to obtain light draught for shallow harbours; these had a centre-well drag. One of these, the *Wm. T. Rossell*, is illustrated on this page.

New demands continued to be made for better and larger seagoing hopper dredgers. This is a field the private contractor has not felt inclined to enter, and since the need is almost wholly a government one, the new developments of this type of plant have fallen upon the United States Engineer Department. The present seagoing dredger is a product of this department in design, construction and operation. Its fleet of 25 seagoing hopper dredgers, serving over 100 different ports or channels on the United States coasts, has as its flagship the dredger *George W. Goethals*, named after the builder of the Panama Canal, where dredgers of many types and classes proved their worth. The Panama Canal, as in the case of the Suez Canal, served as a stimulating influence on design and was a proving ground for many dredging problems. The older dredgers with the government fleet are a product of engineers supplemented by other professions.

Dredging, a dirty, wet, unpleasant game in its early stages, was slowly improved, largely by the experience of practical dregdermen. Its place in the engineering profession was secured as a result of hard work and constant effort toward improvement. At the present time this experience is being supplemented by trained engineers who bring to dredger designing the benefits of mathematics, mechanics and physics, practically applied.

The *Goethals*, the largest hopper dredger in the world, built in 1937-1938, embodies the experience gained in the trying years of history and evolution, which combined with the guidehand of pure engineering has moulded a Goliath of dredging, so essential in the present emergency to the effectiveness of sea lanes and harbours. In the design of this dredger, the various classes of materials to be encountered and physical conditions must be taken into consideration, as well as wind, weather, currents, tides and congestion of shipping. Then, too, to this type of dredger must be added the inherent problems of ship construction, be it steam or Diesel propelled. Much of the smartness of a modern seagoing dredger is in the co-ordination of these two widely-separated factors.

(To be continued)

Poland's National Port

The remarkable development of the Port of Gdynia, the sole outlet of Poland to the sea is narrated in a book called "Poland's Freedom of the Sea," by Colonel Henryk Baginsky, originally published in Poland before the war and now re-written and published in English by the Allen Lithographic Co., Ltd., Kirkcaldy. In 1924, Gdynia handled no more than 10,000 tons of trade. Five years later the figure had grown to 2,620,077 tons, and in 1938, it had further advanced to 8,712,425 tons. In 1924, the average tonnage of ships calling at the port was 532; in 1938, it was 1,001. Passengers who numbered 23,561 in 1929, were 45,263 in 1937. The export of coal grew from 908 tons in 1924 to 6,526,000 tons in 1938. This growth of trade at Gdynia was not without its effect on Danzig, which nevertheless benefited substantially from Polish industrial and commercial enterprise. In 1924, Danzig handled 2,374,557 tons of goods; in 1929, this rose to 8,424,556 tons. Thereafter the economic slump and the competition of Gdynia began to tell, and the tonnage fell to 5,634,176 tons in 1934, but by 1938 had again advanced to 5,982,452 tons.

The challenge of Gydnia to the supremacy of the older German port was, of course, much resented in Germany, and the Nazis did all that lay in their power to retard the development of Gydnia's prosperity. Ultimately, as events have shown, they laid waste the fine installation of port works and equipment which came into being as the expression of Poland's determination to become a maritime nation—an ambition which will be resumed and achieved in due time.

The Harbour and Port of Soller, Mallorca.

*Wave Action in Relation to Harbour Protection Works**

With Special Reference to the Port of Palma, Mallorca

By RAMON IRIBARREN CAVANILLES.

(Concluded from page 131)

APPLICATION TO THE HARBOUR OF PALMA.

As a first case of practical utilization of the method described, we have applied it to the project for a protective breakwater at the harbour of Palma de Mallorca.

Following the exposition given, a summary explanation of the following methods will suffice to determine the three wave charts attached.

With its orientation, the Bay of Palma is only exposed to tempests from directions varying between the South-West and South-East, and accordingly we have studied these two extreme tempests and their intermediary, that of the South.

Approximating the wave lines corresponding to these three directions, respectively, at 600, 300 and 400 kilometres, the maximum heights of the generated wave obtained by means of the formula $2h_0 = 1.2\sqrt[4]{F}$ approximate to 5.93, 5.04 and 5.36 metres respectively, and the relative lengths obtained from the expression $2L_0 = 3.5(2h_0)^2$ will not differ much from 123, 89 and 100 metres.

With these approximate data, a commencement can be made by drawing the plans of the corresponding waves, on the chart of the Hydrographic Commission, called Chart of the Island of Mallorca, and for each of these, lines, representative of the originating wave in the open sea, are taken for convenience of drawing, the equidistant points situated at a distance $A_0 = 50 L_0$, or say 3,075, 2,225 and 2,500 metres respectively.

By means of successive advances of these points corresponding to 50 semi-periods or 50 L, there have been drawn, keeping to the method previously explained, the three wave plans corresponding to storms from the South-West, South and South-East with their wave lines and their normals.

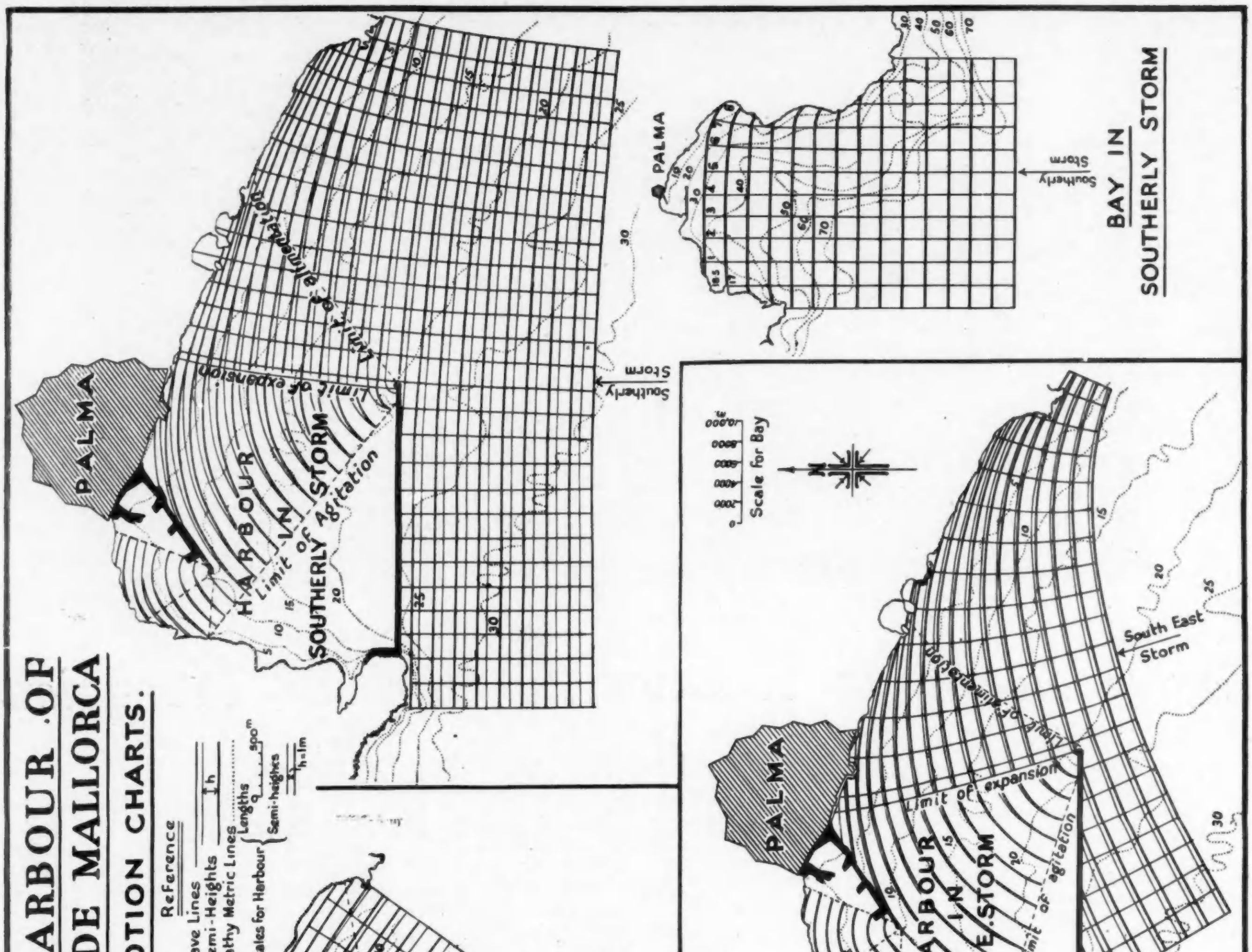
In the plan corresponding to the South-West storm will be observed a free lateral expansion from the point A, since the normal $A\,22'$ is separated from the coast-line to the left.

The maximum expansion corresponds to the situations of the wave 1, 2, 3, 4, in which the energy corresponding to the zone of alimentation 2-4 strengthens the expanded wave 1-4, the semi-altitude of which approximates to $h' = h\sqrt{\frac{2-4}{1-4}} = 2.41$. In the section of the corresponding wave, this semi-altitude $h' = 2.41$ metres gives us the point B, which defines for the sinusoid continuous approximate representation of the semi-altitudes of the expanded wave, lateral although partially, of which the maximum is at C.

The semi-altitudes corresponding to the points 2 and 3 maintain themselves as far as 2′ and 3′, through having no sensible expansion in the areas 2-3 and 2′-3′ from which we know, equally in plan as in heights, the characteristics and situation of the said area 2′-3′, which we transfer to the plan of the harbour of Palma in order to continue with the advance of the wave to a more convenient scale.

The lesser scalar reduction of this detail plan allows the wave advance lines to be duly defined, diminishing to only five semi-

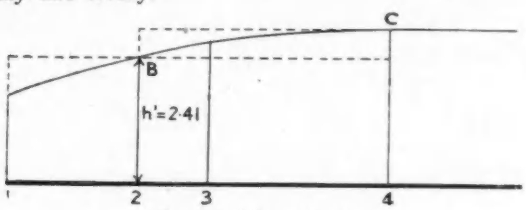
*Translated from the Spanish article, "Obras de Abrigo de los Puertos," in *Revista de Obras Publicas*, January, 1941.


BAY & HARBOUR OF PALMA DE MALLORCA
WAVE MOTION CHARTS.
Reference
Wave Lines
Semi-Heights
Bathy Metric Lines
Scales for Harbour
Lengths
Semi-heights
PALMA
HARBOUR IN SOUTHERLY STORM
Limit of Agitation
Limit of expansion
Limit of alimentation
Southerly Storm
BAY IN SOUTHERLY STORM
Scale for Bay
HARBOUR IN S.E. STORM
South East Storm
BAY IN S.E. STORM
HARBOUR IN S.W. STORM
BAY IN S.W. STORM
South West Storm

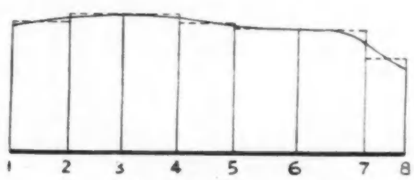
Wave Action in Relation to Harbour Protection Works—continued

periods the time of advance instead of the fifty, with which we have worked on the related plan. As a consequence, the corresponding advances will be 5*L* or, say, five semi-lengths in place of 50*L*.

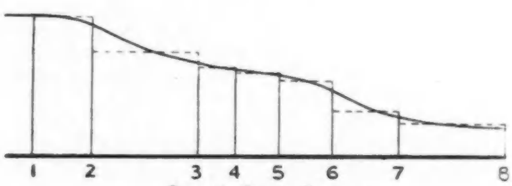
In this wave chart, for the South-West storm, a lateral expansion takes place at the extremity of the proposed breakwater, and the linear limits of its zones of alimentation, expansion and agitation are clearly determined by the method described, adhering to which there can also be determined the quadrants of the sinusoids, representative of the heights of the waves expanded laterally and totally.



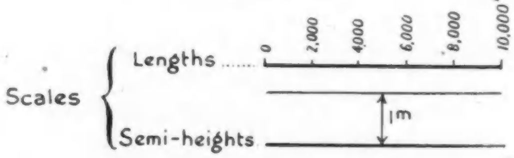
South West Storm



South Storm



South East Storm



With this we draw the corresponding wave chart in which with sufficient approximation for practical purposes can be determined both the direction and height of the wave in any part whatever of the future harbour, as also the zones completely protected therein.

To avoid recasting the limiting line of the agitated zone, the face of the breakwater constructed remains the extent of harbour actually totally protected from the South-West tempest.

Following an analogous procedure in the case of the South tempest, we draw its general wave chart to a reduced scale, in which there are only trifling frontal expansions until the originating wave in open sea reaches the position 1, 2, 3, 4, 5, 6, 7 and 8, the mean heights of which and the approximate continuous profile we draw in the corresponding graph.

We pass afterwards to the area 3-5 and its altitudes corresponding to the plan on the larger scale, and we proceed by determining, as in the case of the South-Westerly tempest, its successive advances and heights, taking into account that in this case of the Southern tempest there is a lateral expansion at the extremity of each one of the projected and constructed breakwaters by which there is produced a certain amount of agitation in the interior of the actual harbour.

In the general wave chart to reduced scale corresponding to the South-Easterly tempest is produced a great frontal expansion which results in the wave, on reaching in its advance the position 1, 2, 3, 4, 5, 6, 7 and 8, experiencing the great drop in heights in its zone to the right, which is represented in the section of the corresponding wave, the section 6-7 of which is transferred to the plan of larger scale, in order to continue its advance and draw the wave plan corresponding to this direction of the South-Easterly tempest.

Viewing these three wave plans, corresponding to the tempests from the South-West, the South and the South-East, it can be noted that the forces of the two first are comparable, and that the shelter afforded by the projected breakwater is more efficacious as regards the South-West tempest than the South tempest, which is, in its turn, the most devastating storm for the work in question due to the normality with which its waves attack it.

The projected breakwater affords much less shelter against the South-East tempest, which will penetrate into the interior of the future harbour in any case, though, fortunately, it will lose its potential violence by reason of the natural protection due to the shape and lie of the coast as also to the arrangement of the quays.

There is then, fixed with sufficient approximation for many practical requirements by this method of wave charts, as much as it is necessary to know in order to solve any problem whatever which presents itself; for example, to decide whether it is more convenient, as economical as practical, to improve the shelter of the future harbour by means of the construction of a counter-mole which, starting from the coast in a direction more or less approximating to North-South, or if it is possible or preferable to obtain equal results by means of the prolongation of the projected breakwater in a direction more suitable to the end in view.

It is unquestionable that with the method described, which still permits of elaboration, it is possible to solve with a greater degree of approximation than risky intuitive methods, so much in vogue until to-day, these important problems of maritime engineering, in which there have been in the past frequent and costly errors, with ensuing disastrous results.

Publication

Pest Infestation of Produce.

The Department of Scientific and Industrial Research has just issued a pamphlet* which is another in the series dealing with aspects of the problem of infestation of produce by insects. It first describes the kinds of insects which are most commonly found on dried fruit, and how and where to find them. The measures which should be taken to keep the warehouse clean and to rid it of a resident insect population are then outlined.

The greater part of the pamphlet explains in detail how the dried fruit itself can be cleaned by fumigation with a mixture of ethylene oxide and carbon dioxide in a cheap and easily erected fumigation chamber. This can be supplemented, when the fruit is in store, by the regular use of an insecticidal spray, which is specified.

The information should be serviceable to those in charge of warehouses and stores in which supplies of dried fruit are housed.

Dredging at Entrance to Delaware Bay.

Work is about to be commenced, or is already in hand, on the removal by dredging of two million cub. yds. of spoil off Cape Charles, Virginia. The estimated cost is $500,000 and, when completed, the channel from the present harbour out across the bar to South of Plantation Light, will be 500-ft. wide by 18-ft. deep. It will double the size of the harbour, the depth of which will also be 18-ft.

*"The Control of Insects Infesting Dried Fruit," published H.M. Stationery Office, price 6d. net.

Power-operated Fire Ladders

Improved Telescopic Arrangements

By C. C. DOWNIE.

Among the essential features of fire-fighting equipment are fire ladders, and these should be available no less at the quayside and in port areas than in residential districts.

Recent developments in the construction of telescoping power-operated fire ladders have encouraged modern designers to construct types consisting of six telescoping sections, which have an extending height of 150-ft. Previously, investigations had amply confirmed the practical utility of the five-sectioned ladder, which

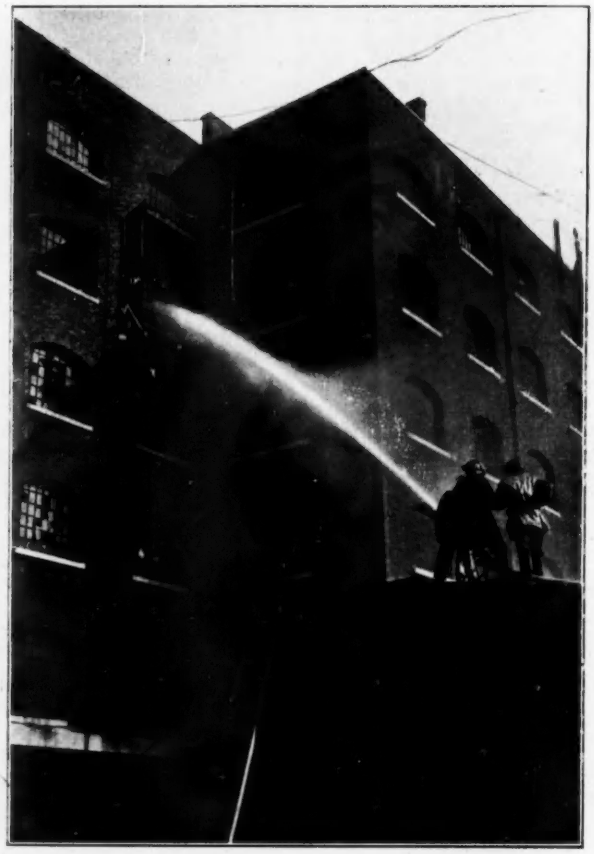


Photo by] [Sport and General

Use of Ladders at London Dock Fire during an Air Raid.

when extended had a height of 126-ft., and the additional height soon proved that a wider extent of applications was possible. The running gear is braced against the ground with the assistance of four screws which are carried in heavy cross-beams, so as to overcome any swaying which might arise from the pneumatic tyres which are used on the wheels, and also to assist in stabilising the ladder when fully extended. The elevating motion of the ladder automatically puts the chassis springs out of action, and in the converse manner, when the ladder is lowered, these springs are again returned to action.

A wide reinforced chassis is preferred upon which the ladder is built up, whilst the engine supplied is rated at 100 h.p., although there are models of smaller dimensions which do not necessitate this power It is doubtful if a better example of power transmission could be gained by studying the individual units comprising the ladder driving gear, in which the clutch-shafts for the different drives are horizontal, instead of being vertical as they were formerly.

The vertical drive shaft, from the universal joint shaft of the running gear, however, is actuated over a pair of spur and bevel gears. The forward and reverse reduction shafts, in turn, are driven from this single vertical shaft. The main clutches, by these means, may be readily exposed by removing the top section of the housing, and lifted out with their shafts from the lower bearing halves, when necessary. In respect of the extending-drive for the ladder, a high speed is provided besides the regular slow speed, and both gears are actuated from the same shaft, whilst the clutches for the inclining motion are also driven through the same medium.

For extending the ladder, the rope drum is centrally located on the drive-housing, and which is driven over a spur gear reduction from the clutch shaft. The extending cable from this drum runs over an axially moveable return sheave, which is located within the precincts of the elevating frame, and from thence passes on to the head of the lowest section of the ladder. The elevating and inclining drives have their motions selectively transmitted at high speed, or slow speed, through spur and bevel gears to the elevating spindle. In order to permit this gear to be arrested with precision, even although the ladder may be rapidly inclined, the clutch shafts of this drive are acted upon by means of an automatic brake. For the lateral adjustment of the ladder, and for compensation of obliquity up to a fixed percentage, the drive is connected, or flanged from the outside, on to the drive housing. The equipment at this point includes a bevel reversing gear furnished with oil-operated clutches connected to a lateral compensation spindle, by means of universal joint shafts over the hinge axis of the elevating frame.

Clutches, which to-day appear to be preferred for this work, are of the double-acting, friction-cone type; these are operated by oil pressure applied from inside, so that the loose clutch-halves are continuously driven from the reduction shafts. Those clutch-halves, which are fast on the shafts, are only carried along when oil pressure is admitted to the clutch, whilst the oil itself is provided by a pump under pressure, the latter being built into the drive-housing. This oil pressure is adjusted from outside by means of a safety valve, whilst oil ducts are cast into the former housing, thus making all sections of the power transmission easily accessible and simply controlled.

Comparison of Steel and Wooden Ladders

In fire-fighting operations it is to-day recognised that the load and stresses upon the ladder are continually varying, and that they become more acute with the need for greater effective ladder heights.

All-welded steel constructions of the hollow order, besides affording greater strength and safety than previous wooden equipment, have probably done most to make possible further increases in height extension, seen to best advantage in the upper sections of the ladder. Wooden ladder sections which are still in use are frequently strengthened by steel trussing, which means that there is a co-action of materials possessing entirely different physical properties, since further, the former are guided by steel fittings. It has previously been pointed out that irrespective of how careful may be the selection, no two wooden ladders ever exhibit the same properties, and hence variations in warpage and strength can result from the action of the weather.

During variations of weather, it may be necessary repeatedly to rectify this trouble by adjustment of the tension trusses.

These drawbacks have resulted in the development of the all-welded, thin-walled ladder, which gives high resistance to flexure and torsion, and offers increased loading capacity of the ladder-top, by reducing the weight of the upper sections. The upper chords are constructed for carrying purposes when supported at either one, or both ends, or for tension and compression, with truss struts in the central plane of these units. Whereas with wooden ladders the first and second sections are on top of each other, the design of modern steel ladders allows of all sections to be guided within each other. During the operations of extension and telescoping, the need for special guide yokes is obviated, as the sides run with their entire lower curved surface on broad rollers, which are carried on selected bearings. These bearings are welded to the inner cheeks of the ladder sides, and to the rungs. As regards the overhanging part of the ladder, this rests upon double rollers which are connected to tilting levers. Although different designs

Power-operated Fire Ladders—*continued*

of modern steel ladders are in use to-day, a close symmetrical hollow section appears to be preferred for the ladder sides forming the lower chords; and this is made by welding appropriately shaped halves of sheet-steel on both sides along the centre line. As regards the rungs used, the sides of the ladder are connected by those of general rectangular cross-section with rounded corners to ensure a sound grip, whilst to increase the resistance to twist, those rungs which are located between the truss struts are purposely of greater cross-section.

The rungs in the climbing range are equipped with ribbed rubber coverings, so that during severe winter weather, the hands are protected and prevented from slipping.

Advantages of the Modern Steel Ladder.

During life-saving operations, as the side trusses have been calculated for compression loading, the ladder may be leaned against a building with its point, whereby it may be employed as a bridge, which will have the advantage of non-inflammability.

It has been found necessary to use seamless steel tubing of various thicknesses for the struts, truss, upper chords, and diagonals, which are welded to the sides in the perpendicular central plane.

In all section-trusses, the tops are on the same level and overlap each other, an arrangement which also obtains when the ladder is fully extended, so that advantage of it can be taken to guide a life-saving basket where required. When making tests to compare the working performance of steel ladders with those of wood, it was found that the deflection of the metal outfit was some 73 per cent. of the latter, i.e., using a wooden ladder top with steel trussing, whilst in respect of weight, a steel ladder of equivalent length weighed 74 per cent. less. Comparisons have been made of the increase in weight of the different sections comprising the multi-part steel ladder, with those of wood, and the weights of the lower sections are so proportioned that with ladder elevated, a sufficient compensation is offered for the tipping moment of the upper sections, whilst further, pre-determined weights were hung from the tops of the ladders to note if the deflection remained within admissible limits. Using the ladder with five telescoping sections. of 126-ft. at full extended length, it was claimed that a weight of 775 lbs. could be suspended without appreciably influencing the deflection. In a further series of tests made on torsional deflections on both right and left-hand sides, the steel ladder was claimed to show 50 per cent. less than corresponding wooden ladders.

It should be understood in all such tests, that besides the completely extended ladder being examined, the sections of which it is composed have been compared individually.

Some Supplementary Features

In conclusion, a few supplementary remarks on the nature of one of the latest turntable designs may be of interest. The turntable and elevating frames are connected by a heavy elevating spindle which is made of selected alloy steel, and is so constructed that its leverage is greatest in those positions where the ladder is most widely employed, while the equipment includes universal joints and a special gun-metal nut. As the elevating frame also acts in the capacity of a box-form truss, it is pivoted in bearings, seated on a tubular cross-member in the turntable outrigger. A safer support is understood to be obtained compared with former ladders, as the length of the elevating frame is more than one-third of that of the bottom section of the ladder. In constructing the ladder, arc-welding is mostly preferred, as it has proved best for thicknesses down to 0.04-in., and apart from joining the thin-walled sections, it is also utilised for the framework built up on the turntable, with its outrigger for the reception of the elevating frame. Butt-welding is, however, preferred for connecting the two main sides by means of plates, whereby a particularly stiff box-type beam is obtained, within which the ladder driving-gear is amply accommodated without difficulty. Plates for the side walls are produced by oxy-acetylene cutting, whilst reinforcing flanges are welded in position with double fillet seams. The turntable is borne upon an annular ball-track, whilst an adjustable ball-ring is used under the platform to take the upward thrust caused by the tipping moment, and the bearing base for the turntable itself is directly bolted to the frame trussing of the running gear. One feature which at all times was regarded as being detrimental to the wooden type of ladder, was the need for circuitous seasoning of the timber used, which meant not only a waste of time, but also a hold-up of the capital involved. In some instances it was ascertained that not more than 20 per cent. of the log-cross section was fully utilised, whilst it was expected that the best knotless pinewood would be adhered to, and this frequently had to be in lengths of not less than 33-ft.

In order to train firemen readily who may not be acquainted with all the latest developments of a fresh design, a modern tendency appears to be to provide specially prepared and detailed working drawings, in sections. These first provide a rough indication of the main features and motions involved, after which the more fully detailed constructional diagrams may be consulted. In view of the suggestion that the hollow steel ladder might be the means of conducting heat during an emergency and particularly where the ladders might be demanded for continuous operation, as compared with the natural heat-insulating qualities of wood, a further series of investigations was carried out. Although proposed improvements in the nature of linings of heat-insulators for the interiors of the tubular sections were tried, it was soon ascertained that these, in most cases, were superfluous, as the hollow construction was rarely the cause of heating up appreciably. The foregoing ladders are the work of different modern producers who appear to work on much the same lines, although small practical details may differ. but on the whole it will be appreciated that nothing is left to chance or speculation, so that heavy duty and continuous service at operating heights unknown to the wooden ladder will cause no difficulties.

Dock Appointment at Blyth.

After three years as assistant commercial manager, Mr. Alan Greig has been appointed secretary of the Blyth Dry Dock and Shipbuilding Co., Ltd. Mr. Greig was, for a period, manager and secretary of the Ocean Dry Docks Co., Ltd., Swansea.

Heavy Cargo Discharge at Suez.

There recently appeared in the press a statement indicating heavy shipping traffic at the Port of Suez, where the present average volume of cargo handled is some 8,000 tons per day as compared with 800 tons per week in pre-war times. In periods of pressure (last June and July for example), the rate of unloading was close on 10,000 tons daily. The port accommodation has accordingly been developed to an enormous extent. "It is doubtful," said the statement, "whether those who knew the harbour in 1939 would recognise it now or easily be able to find their way about among the mass of new quays that have appeared where once were only sandy flats."

West Country Docks Staff Changes.

The following changes have recently been made by the Great Western Railway Company at their West Country docks:—

Mr. R. Dixon, dock manager at Plymouth, has been appointed assistant to the chief docks manager at Cardiff. Before going to Plymouth Mr. Dixon was for many years attached to the chief dock manager's office at Cardiff. He is being followed at Plymouth by Mr. L. J. L. Lean, depot manager, St. Mellons, Cardiff, who for a long time prior to going to St. Mellons served on the dock manager's staff at Cardiff. The assistant dock manager at Newport, Mr. R. H. Rice, becomes depot manager, St. Mellons. The position of assistant dock manager at Newport goes to Mr. F. C. Coleman, who has been head of the commercial section of the chief dock manager's office at Cardiff. At Swansea, Mr. R. J. Jones, chief clerk, has been appointed assistant to the dock manager, and Mr. J. C. Thomas, head of the coal shipping section, Barry, is transferred to Swansea as chief clerk.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in this Journal should not be taken as an indication that they are necessarily available for export.

Temporary Dams

An Article for Students and Junior Engineers

By STANLEY C. BAILEY, Assoc.M.Inst.C.E., F.G.S.

TEMPORARY DAMS are frequently required during the construction of new harbour works, basins, docks and locks, and also in connection with the enlargement of, or alterations to existing harbour works, so that the operations may be carried out more expeditiously and satisfactorily in the dry and at less cost than if done under water.

There are several types of dams in general use, and the particular form employed depends upon the depth of water to be retained, the nature of the sea bed soil, the speed at which the work can be done, the possibility of obtaining suitable materials, and the cost.

Types of Dams

Among the types of dams in general use, are:

(1) Banks of earth, gravel and dredged material, sometimes surmounted by a small concrete wall.

(2) Dams constructed of mass concrete, either straight or curved in plan to the arc of a circle, deposited in the water between timber or metal shuttering.

(3) Steel dams formed of sheet steel interlocked piles or needles, with walings bearing against steel frames at the back, spaced 6 to 8-ft. apart. The frames carry steel joists on which counterweights are placed, consisting of kentledge or cast iron ballast in rectangular blocks.

(4) Timber-built dams, formed of a single row of sheet piling with walings, and shores or struts at suitable intervals at the back bearing against soldier piles.

(5) Puddle dams of timber constructed of two parallel rows of sheet piles from 5 to 8-ft. apart, with walings, tied and braced at intervals, the space between the rows being filled with puddle clay; this type of dam is also usually strutted at intervals at the back.

(6) Box, or limpet, dams constructed as three-sided timber or metal boxes with a bottom, that can be fixed against a basin wall to enable small operations to be carried out in the dry, such as repairing and fixing timber fenders to walls or for drilling holes in the wall for bolts to fix the steel castings that support the boom pivots of off-shore floating docks.

Dams of types Nos. 1 to 5 have usually to be constructed in tidal water, and when nearing completion, a gap is left in the dam to allow the water at high tide to flow out until low water is reached, then the breach in the dam is rapidly closed, and the water remaining inside is pumped out. If the gap in the dam cannot be closed rapidly, then sluices are provided in it for the same purpose.

It is advisable to arrange for the closing of the gap at spring tides, for then there will be less water to be pumped, and during the pumping operations, as the level of the water falls inside the dam, careful watch should be kept for any signs of weakness such as movement of the dam, leaks, and " blows " or rushes of water under the dam, these should be remedied as soon as possible.

Sometimes a dam, which is otherwise watertight and stable against overturning, will slide bodily, due to the water pressure compressing the ground horizontally at the back of the dam, causing it to rise in waves, while, in front, there is a gap left between the sheet piling and the soil, which is at once filled with water, increasing the head of pressure on the dam which may cause a " blow." Some dams have been known to move bodily a distance of 5-ft. or more.

Should this happen, then puddle clay should be deposited on the front and also at the back of the dam, the latter deposit being covered with a bank of gravel and sand or dredged material to add weight.

Earth Dams.

Earth dams are usually used for cutting off the sea during the construction of the walls for new basins and docks; the dams being formed of either tipped earth, stones and rubble from quarries, or dredging of earth, clay, sand and gravel having slopes of 1½ to 1 on the inside, and 2 to 1 on the outside above low water level, and 3 to 1 below low water. Should quarry refuse, which should include earth and clay, be used in the construction of the dam, a timber jetty carrying a railway on piles is first built on the line of the dam, so that the materials may be deposited either by tipping wagons, or hopper wagons with hinged bottoms direct from the excavation or quarry.

To increase the watertightness of the dam a row of sheet timber or steel interlocking piles is sometimes driven along the outer side of the jetty, the top of the piling being kept above the level of extraordinary high tides, or should there be no sheet piling, and the dam is otherwise watertight, then exceptionally high tides may be guarded against by the provision of a concrete wall on top of the dam.

The outside slopes of the dam for a thickness of several feet should be protected from rough water and scour by the use of larger stones than those in the body of the work.

Earth dams, when they have served their purpose are usually removed by dredgers.

Mass Concrete Dams

Mass concrete dams are usually constructed on coasts where the sea bed consists of rock. The concrete in the proportions of 1 cement, 2 sand, and 3 gravel, or broken stone, is deposited between either timber or steel shuttering, by means of skips or buckets with hinged bottoms, or by means of a clam grab from a crane mounted on a barge filled with the mixed concrete, or a concrete mixer may be fixed in the bottom of the barge, the aggregate and cement mixed, and tipped into the buckets by the mixer. In chalk rock, soft limestones and sandstones, it is generally possible to construct a timber gantry on the line of the dam by driving in piles shod with 2-in. diameter pointed steel rods from 18-in. to 2-ft. long, the piles being arranged on each side of the dam about 10 to 12-ft. apart longitudinally, and braced together both longitudinally and transversely, the head timbers and beams carrying a railway for hopper wagons from which the concrete is deposited through a tremie or tube with a hopper at the top, suspended from the railway beams.

Another method, illustrated by Fig. 1, is to have a travelling platform on the gantry carrying a small crane, concrete mixer and water tank supplied with water through a flexible hose, connected at intervals to a pipe along the gantry from the shore.

The crane lifts the cement and aggregate in a bucket from a barge lying alongside the gantry, and deposits it in the concrete mixer, which in turn tips the mixed concrete into the tremie.

When using the tremie, the hinged door at the bottom is first closed, and the tremie is filled with concrete direct from the mixer, thus displacing the water in it, then the door is opened by divers or by releasing gear from the platform, the concrete pours out, and as its thickness increases, the tremie is raised by disengaging it from the hopper at the top and removing a section of its length, then refixing the remaining lengths to the hopper.

The concrete at the bottom of the dam for 2-ft. thickness should be of a stronger mixture (say 1-1½-3) than that used in the body of the dam, to give better adhesion to the rock.

Before any concrete is deposited, the surface of the rock should be cleaned with wire brushes, and seaweed and mud removed by divers; the surface of the rock should also be roughened and stepped, large stones and loose rock being removed, to avoid the possibility of the dam sliding, this is not a remote possibility, for at Naples in 1908, one concrete side wall 37-ft. high and 16-ft. thick at the base, of a graving dock which has been constructed in the sea by means of a caisson under compressed air, slid bodily

Temporary Dams—continued

across the concrete floor of the dock without overturning, when the water in the dock had been pumped out. A length of about 400-ft. of the wall sheared at the floor level, cracked vertically in several places and slid forward, due to the pressure of 35-ft. of water at the back when the filling had only reached a few feet above floor level.

As the wall weighed about 30 tons per lin. ft., and the water pressure was 17.5 tons, the co-efficient of sliding friction was 0.583.

The shuttering for concrete dams may be of either timber or steel plates in suitable sections bolted together and stayed against the piles of the gantry. The inside of the shuttering should be well greased to prevent the concrete from adhering to it, as it will require to be removed as soon as the concrete sets, to be reused in other portions of the work.

Where spaces occur between the bottom of the shuttering and the irregular sea bed, these should be closed with concrete lowered in canvas bags and rammed into position by divers.

Timber shuttering will require to have cast iron weights attached to the waling at the bottom to lower it into the water, and to hold it down, it will be necessary to drive steel spikes with slotted holes in the top into the rock at intervals on the line of the shuttering; holes are then drilled in the shutter waling to correspond with the distance of the spikes apart, the waling attached to the shutters is then lowered over the projecting spikes, and steel pins are driven into the slotted holes, the weights may then be removed.

The diagonal bracing between the gangway piles in cross section is removed as the erection of the shuttering and concreting proceeds. The demolition of concrete dams, when they have served their purpose, will require to be done by drilling holes in them and blasting with small charges of explosives, the fragments lying on the sea bed being dredged, or a grab crane may be used, according to the sizes of the blocks. When there is sufficient depth of water over the dam, the concrete may be shattered by a Lobnitz floating rock breaker.

There is an element of danger in concrete dams built on cracked and fissured rocks, or on shales and other laminated rocks, of water creeping under the dam, and into the rock fissures several feet below the base, thus increasing the head of pressure, with a maximum uplift due to the head on the heel or water face of the dam, diminishing to zero at the toe, thus forming a triangle of upward pressure as shown in Fig. 2. In this case the resisting moment of the dam at the toe is = W.y. and the overturning moments are P.U. + Q.S. the resultant of P and Q = R, and the moment of R = R.Z. therefore RZ = P.U. + Q.S. or the moment of the dam = W.y. − Q.S. If the weight of the dam, and the uplifting force are treated as an unbalanced couple, then the resultant pressure V = W − Q, and the distance (x) at which it acts outside $W = \dfrac{Q.a.}{V}$ then the moment of the dam will be = V.b. The amounts that give the lowest factor of safety against overturning should be taken.

The final resultant (R1) should fall within the middle third of the width of the base, as this will avoid tension on the face, and the factor of safety against overturning should be at least 2 for temporary and 2.5 for permanent dams.

Fig. 3 shows a graphic method of finding the centre of gravity of a dam, and Figs. 4 and 4a, methods of finding the mean C.G. of a dam, and the vertical water pressure V due to the triangle the pressure A, B, D. In Fig. 5, the mean C.G. line of the vertical water (V) and the weight of the dam (W) from the toe $= \dfrac{W.y. + V.K.}{W + V}$ or the distance b, $= \dfrac{V.a.}{W + V}$.

Since water pressure acts normally to the surface pressed against, the inclined pressure Q is the resultant of the vertical weight of water (V) in the triangle A, B, D and the horizontal force P.

If the normal pressure (Q) is taken, the resultant (R) of the weight of the dam (W) and pressure Q, should be drawn from the point at which Q intersects the C.G. line of the dam; but if the horizontal force (P) is taken, then the vertical water pressure (V) should be added to that of the dam, and the mean C.G. found, the origin of R being the intersection of P, with the mean C.G. line, and the weight will be = W. + V.

The resultants obtained by both methods will pass through the same point at the base of the dam. The moment of the dam and vertical water = W.y. + V.k. or equals (W + V) l the moment of the horizontal water being P.U. or the moment of the dam alone = W.y. and that of Q = Q.Z. this will give a higher factor of safety on account of the inclination of Q, which combines a horizontal with a downward pressure.

In Fig. 6 the dam is shown subject to upward water pressure (Q) in addition to the lateral pressure (P) and the weight of the vertical water (V). The resultants R1 for the inclined pressure P1, and R for the horizontal force P, are shown graphically, the final resultant R2 through the base of the dam being obtained in a similar manner to that in Fig. 5. Fig. 7 shows a method of finding the effective pressure on a dam when there is high water on the front and low water at the back.

If P is the horizontal high water pressure due to head-H, and Q the horizontal low water pressure for head = h, then the height at which the effective pressure on the high water side will act above the base will be $= x = \frac{1}{3}\left(H + \dfrac{h^2}{H + h}\right)$ and the pressure will be = P − Q.

The mean C.G. of the vertical water weight and that of the dam should be found, the moment of the dam being (W + V) l. and that of the lateral water = (P − Q) x.

Figs. 8, 8a and 8b show the graphic calculations for a concrete dam not subject to uplift under it. The dam is 28-ft. high, 4-ft. wide at the top, and 16-ft. at the base, and weighs 16.4 tons per lin. ft. at 17 cub. ft. per ton (131.76 lbs. cub. ft.). The head of water is 25-ft. and the lateral pressure = 8.92 or say 9 tons per lin. ft. at 35 cub. ft. per ton.

The moment of the dam about the toe is 16.4 x 10.5′ = 172.2-ft. tons, and that of the water = 9 x 8.34′ = 75-ft. tons, giving a factor of safety of 2.29 against overturning. The resultant (R) inclined pressure at the base of the dam is 19 tons, giving an average pressure of 1.18 tons sq. ft. (Fig. 8b), it is usual to take the pressure (R) normal to the base, which in this case will be 16.4 in lieu of 19 tons, but as the dam may weigh less than the assumed weight, and muddy highly saline sea water may weigh so much as 70 lbs. per cub. ft. it is advisable to take the higher figures.

As regard the resistance to sliding, assuming that the adhesion to the rock bed is small, and that there is no tendency to uplift, then 16.4 tons x 0.75 = 12.3 tons, the lateral pressure required to slide the dam, and the actual is 9 tons, the dam should therefore be safe against sliding.

The toe of the dam is liable to vertical shear if the pressure per sq. ft. under it is high. If a section is taken at E.F. 3-ft. inside the toe and 6-ft. high, this may be treated as a cantilever with a uniform load and shear = W the total load on it.

The average pressure on the 3-ft. of toe is about 2 tons per sq. ft. or W = 6 tons, and $M = \dfrac{W.L.}{2} = \dfrac{6 \times 3}{2} = 9$-ft. tons and 9 x 12 x 2240 = 241,920 inch lbs. $I = \dfrac{B.D.^3}{12} = \dfrac{12 \times (6 \times 12)^3}{12} = 373{,}248$ inch units.

The depth D being 6-ft. $y = \dfrac{D}{2} = \dfrac{6 \times 12}{2} = 36$ inches and the stress $= \dfrac{M.y.}{I} = \dfrac{241{,}920 \times 36}{373{,}248} = 23.3$ lbs. per sq. inch, or the stress $= \dfrac{M}{Z}$ where Z = the modulus of section $= \dfrac{I}{y}$.

The safe shear for good concrete is 70 lbs. per sq. inch, but it may not be more than 35 lbs. for concrete deposited in sea water. Fig. 9 illustrates a curved concrete dam in plan, this type of dam may be necessary on each side of a basin entrance that is required to be widened from, say 80 to 130-ft. The head of water is 25-ft. and the cross section of the dam is shown by Fig. 9b; the weight

Temporary Dams—continued

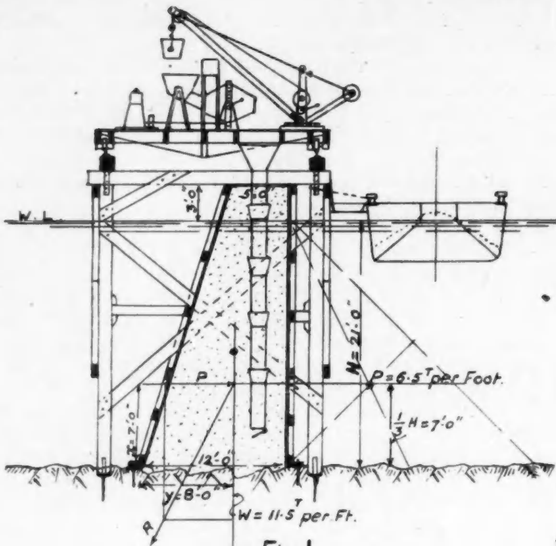


Fig. 1.

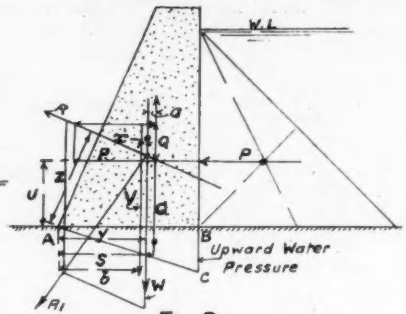


Fig. 2.

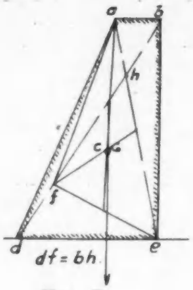


Fig. 3.

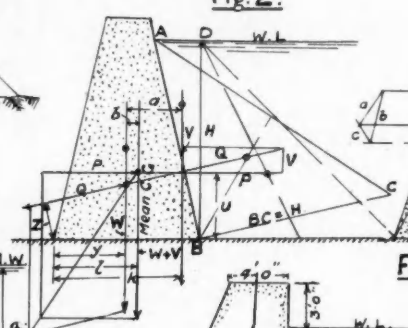


Fig. 5.

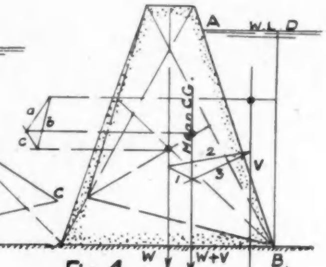


Fig. 4.


Figs 4.A.

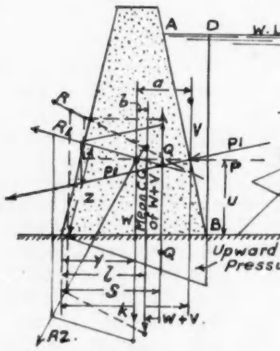


Fig. 6.

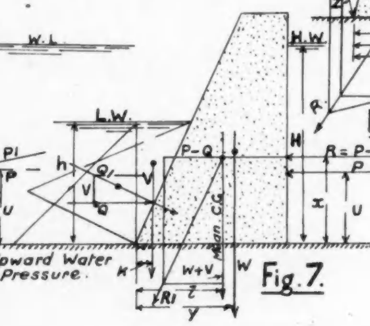


Fig. 7.

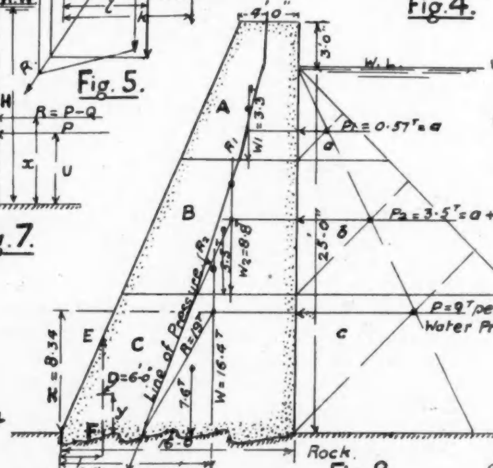


Fig. 8.

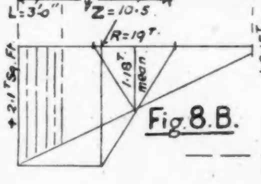


Fig. 8.B.

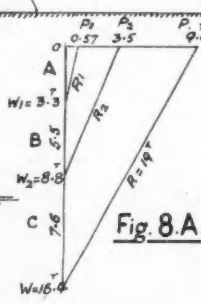


Fig. 8.A.

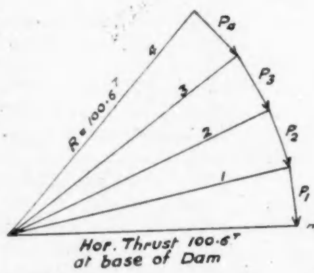


Fig. 9.A.

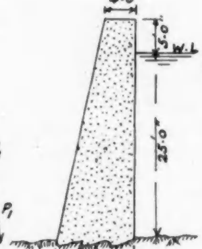


Fig. 9.B.

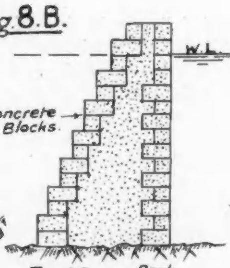


Fig. 10.

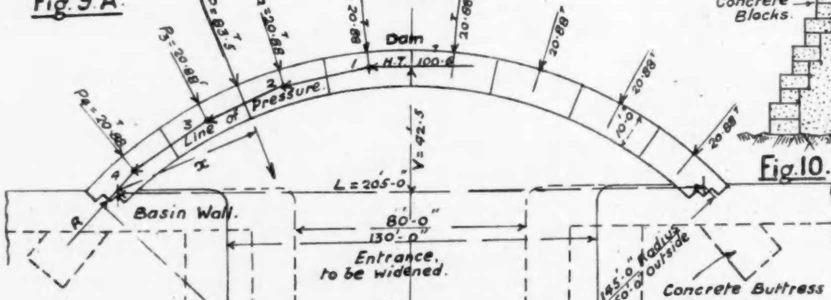


Fig. 9.

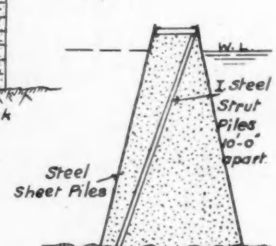


Fig. 11.

Temporary Dams—continued

pressure is 9 tons per lin. ft. The radius of the dam is 150-ft. to the face, and length on the arc is 235-ft. The total pressure on the dam will therefore be 235-ft. x 9 = 2,115 tons = P. and the horizontal thrust, $H = \frac{P.L.}{8.V.} = \frac{2,115 \times 205}{8 \times 42.5} = 1,275.2$ tons where L length of chord of arc, and V = the versed sine or rise.

This will be the pressure against the walls of the basin forming the abutments of the dam, amounting to an average of 6.07 tons per sq. ft. If the basin wall has an area in cross section of 290 sq. ft. the average shearing force will amount to 4.3 tons per sq. ft. with a maximum of 10 tons per sq. ft. at the base.

The safe shearing strength of concrete is 70 lbs. per sq. inch (4.5 tons per sq. ft.) or about one-tenth of the safe crushing strength = 700 lbs. sq. in. (45 tons sq. ft.) so the wall will be safe against shearing, but it may not be so against sliding, in which case it is advisable to cut a trench at the back of each abutment, and fill in with concrete to form a buttress. The maximum pressure at the base of the dam is $\frac{25 \times 1' \times 1'}{35} = 0.71$ ton sq. ft. and 0.71 x 235' = 166.85 tons, say 167 tons. The H.T. = $\frac{167 \times 205}{8 \times 42.5} = 100.6$ tons, or the H.T. = $\frac{P.x.}{V}$ where P is half the total load on the arch, and x the leverage of P. from the abutment.

Fig. 9a shows the diagram of thrusts on each section of the arch. The compression on the lower 1-ft. of the dam = $\frac{100.6}{10 \times 1}$ = 10.06 tons sq. ft. and the safe compression on concrete laid in sea water may be taken at 400 lbs. per sq. in. or 25.71 tons per sq. ft.

The use of special shuttering or forms for concrete dams may be avoided by constructing the facework of concrete blocks about 4' x 2' x 2', as illustrated in Fig. 10; the sea bed on the line of the blocks having been levelled by divers, and as each course is laid, the concrete is deposited by buckets from a crane mounted on a barge, containing the aggregate, cement, and concrete mixer.

The dam may also be constructed inside sheet steel interlocking piles driven into the rock so far as possible by a floating pile driver. Walings of channel steel are fixed along the top of the piles, with steel struts between at 10-ft. intervals, and a diagonal strut pile, as shown in Fig. 11.

(To be continued)

Notable Port Personalities

XXVIII—Brigadier C. M. Hoffe

Brigadier Charles Mitchell Hoffe, General Manager, South African Railways and Harbours, the Administration for the Ports of the Union of South Africa, and Director of Railways, Harbours and Sea Transport in his military capacity, was born in Ballina, County Mayo, Ireland. on the 17th October, 1885.

Brigadier C. M. HOFFE.

He went to South Africa in 1897 and was educated at the Diocesan College, Pretoria, St. John's Boys' School, Boys' Model School and the Pietermaritzburg College.

Brigadier Hoffe commenced his career in the Chief Accountant's Office of the Transvaal Repatriation Department in 1902 and was transferred to the office of the Attorney General in 1904; on the consummation of the Union of South Africa, the Attorney General's Office of the Transvaal became the Department of Justice. During 1913, he was appointed Assistant Secretary to the Native Lands Commission.

In 1914, he was transferred to the office of the Minister of Railways and Harbours and shortly after, with the outbreak of the Great War, proceeded on active service with the 1st South African Mounted Brigade to East Africa, where he was mentioned in despatches.

In 1921, he was appointed Private Secretary to the Minister of Railways and Harbours and in 1923, was appointed to the dual post of Private Secretary to the Minister of Railways and Harbours and Secretary to the Railway Board.

In September, 1929, Brigadier Hoffe was appointed Superintendent (Staff) in the office of the General Manager and became Chairman of the Staff Committee. With the inauguration of the Staff Control Board the following year he was appointed a member of that Board. In 1933, he took office as System Manager, East London, and in 1935 was promoted to the post of Chief Staff Superintendent, also becoming Chairman of the Conciliation Board.

In November, 1936, he was appointed Understudy to the Chief Accountant, afterwards becoming Assistant Chief Accountant and Chief Accountant in September, 1937.

Brigadier Hoffe was promoted to the position of Assistant General Manager (Commercial) in May, 1939, and assumed office as General Manager in February, 1941.

Traffic at the Port of Marseilles.

The Marseilles Chamber of Commerce (as reported in the Continental Press), states that traffic through the port has been limited to shipments to and from North Africa and some other French colonies since the armistice of June, 1940. About 75,000 tons of coal are at present passing through the port each month, while imports of Tunisian rock-phosphates have risen to 50,000 tons a month. Quantities of fruit, wine, coffee, cocoa and wheat are also imported through Marseilles, but the total traffic reaches only 70 per cent. of the pre-war volume. Before the war, coal imports were one of the most important items and amounted to over 1,000,000 tons a year. Compared with other French ports, Marseilles is in a favourable position owing to the fact that the other three principal ports—Bordeaux, Nantes and Rouen—are all in the occupied zone.

Port Planning and Terminal Design in Relation to Economical Cargo Handling*

By H. E. STOCKER,
Assistant Professor of Transportation, New York University, and
Director of Harry E. Stocker Associates.

(Concluded from page 144)

Turntables for Motor Trucks.

As stated previously, one of the difficulties created by motor trucks on piers is the amount of time it takes a large truck to turn around. This operation not only delays other trucks, but interferes with economical stevedoring operations.

A possible solution of this difficulty is the construction of turntables at the outer end of a pier. A railroad solves the problem of turning engines around with a turntable. At Jersey City, N.J., a turntable is used to turn around 'buses in a narrow space between railroad tracks. Why not then use the same idea for motor trucks on piers?

Railroad Traffic Relatively Unimportant in Honolulu

In Honolulu, rail traffic is of relative unimportance. It will probably be supplanted entirely when legal and other handicaps to the sound economical development of motor transportation are ended, because even the longest haul is short according to mainland standards.

But even a few cars on a congested terminal add to the stevedore's difficulties. This trouble can be overcome to some degree by switching empty cars quickly after they are unloaded and by spotting cars on the piers at some location other than opposite the ships. For example, if large, heavy cases are to be unloaded from a box car with a crane and fork truck working together or by means of a skid, the car should be spotted where this operation will interfere the least with stevedoring operations as well as motor truck traffic.

This is true even if the car is spotted in a yard outside the shed, for with proper use of modern equipment the added trucking cost is more than offset by the reduction of congestion on the pier.

Depressed Tracks Handicap Cargo Handling.

Where a terminal has depressed tracks within the shed, interference with cargo handling operations and motor truck movements is even more marked than when cars are switched on to a pier fitted with surface tracks within the shed.

It is questionable if depressed tracks are necessary with modern cargo handling equipment such as pallets and fork trucks.

If cars are spotted on a flush track in the interior of a shed or on the apron, cargo can be unloaded on to a pile of pallets placed at the car door. When the top pallet has been loaded, it is removed by a fork truck and the second pallet is loaded. When two or three pallets have been removed from the pile, more empty pallets are added.

The only difficulty is when large, heavy cases are being unloaded from a box car with a portable tractor-mounted crane, but this difficulty hardly justifies the adverse effect of depressed tracks on handling cargo economically, and their interference with motor truck movements.

For these reasons, the writer asks: Should not many depressed tracks be covered over so that old terminals will better fulfil the needs of modern land transportation and to make the most effective use of modern cargo handling equipment?

Additional Studies must be Made

Such a plan cannot be followed blindly. Each terminal and all of its operations should be studied in detail to determine exactly what should be done to obtain the best net results. Such a study must obtain all pertinent facts, and give consideration as to how other terminal operators and designers have met the problems created by new equipment for land transportation.

The writer remembers vividly how the operations on an Atlantic terminal were handicapped by a depressed track down the centre of the pier. It was not used for railroad cargo, for all cars were handled either on track outside the shed, or from car floats and lighters, yet there it was, always in the way.

The local representative of the owner of the pier was asked to cover the track, but nothing happened until the chief executive made a visit to the terminal and the difficulty was explained to him. Two days later the carpenters were at work covering that annoying depression in the centre of the pier.

Depressed Tracks on Inshore Side of Terminal are Advantageous

Depressed tracks on the inshore side of a quay type terminal are advantageous, provided the volume of rail traffic is such that this area can be utilised to the best advantage for railroad cars, rather than for motor trucks. When this track area is paved, both railroad cars and trucks can be handled.

As far as Honolulu, as well as other Hawaiian ports were concerned, the writer recommended that cars be kept off congested terminals and that depressed or surface tracks within a pier shed be avoided.

New Territorial Terminal Needed.

In spite of improved cargo handling, utilisation of open areas, improvement in the conditions with respect to motor trucks, and other steps taken to utilise better the present facilities at Honolulu to relieve terminal congestion, the facts indicated that a new Territorial terminal was needed. This is true, because of a lack of terminal space and the need for maintaining adequate competition between Territorial and private terminals.

The writer believed that the lack of Territorial wharf construction in the past ten years, as well as the number of obsolete and useless piers in existence, themselves indicated the need for new Territorial pier construction.

The present congestion is not only costly to steamship lines and stevedores, but looking at the broad economics of the problem it is an unnecessary tax on the people of Hawaii, for congestion increases the costs of steamship lines and ultimately tends to increase rates.

The alternative of relying upon private interests for adequate facilities is not in accord with port policies in most ports, except where competition between ports is active. Such competition keeps other ports on the alert. This, however, is not true of Honolulu.

Precedent suggests that the solution of Honolulu's port problems lies in exercising a larger measure of public control. A more immediate need, however, and one probably easier of accomplishment, is the provision of new Territorial pier space.

Besides the above, an important consideration is the provision of additional facilities in Honolulu so that the Board of Harbour Commissioners can have sufficient revenue to provide for facilities at other Hawaiian ports.

Another consideration is the lack of suitable berths for large liners under construction or contemplated. For example, the new American President Line ships are to be 740-ft. in length.

Since new Territorial pier space is needed, the next question is where it should be provided.

*Paper read at the Annual Convention of the American Association of Port Authorities held at Miami, Florida, in November, 1941

Port Planning and Terminal Design—*continued*

Selection of Site for New Terminal

The site selected was that occupied by the obsolete quay type terminal designed as Pier 15. (See Fig. 6). This was the logical site, for there is the only property owned by the Territory and accessible to rail facilities.

The location of the terminal involved a study of street traffic problems, for the site most profitable from a purely port point of view was on busy Queen Street, which borders the main business section of the City.

It was thought originally that a larger terminal at this point would increase street traffic, causing congestion, and that therefore the new terminal should be located at another site where the street traffic problem was less troublesome.

The writer studied the traffic flow charts of the City Planning Commission and talked with its members and the chief engineer.

In making this study he was guided by the principle that it was reasonable to expect the street traffic to fit port needs and not to make a limited harbour fit the street traffic conditions. Street traffic is comparatively more flexible than the shore line of a port.

It was clear that the best site from every standpoint was on the busy Queen Street, where Pier 15 is located.

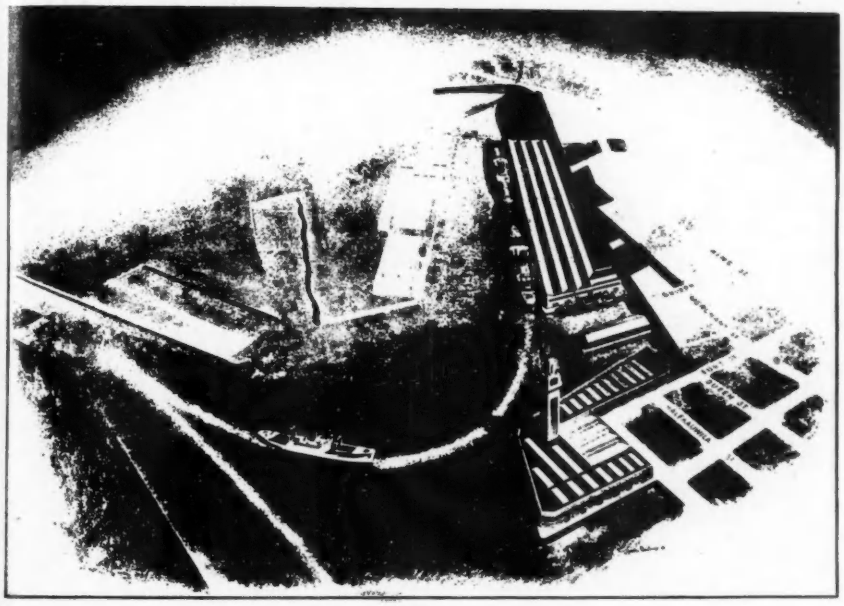


Fig. 6.

It was thought that any increased street traffic, due to the large terminal at that point could best be taken care of by the proposals for widening Queen Street, by elimination of left-hand turns, by the construction of a ramp over the railroad tracks, by provision of parking space for pier traffic, and by providing a by-pass for through traffic from Pearl Harbour and beyond to Waikiki and beyond. This by-pass could be provided by widening a street which avoids the business district. It was found that street traffic needs not connected with Pier 15 traffic, require these improvements.

The actual amount of increased traffic as a result of a New Pier 15 and its effect upon other traffic during periods of greatest congestion, seemed to be relatively small.

The objections raised because of additional traffic that would be created on Queen Street were unsound, because the added traffic would be a comparatively small percentage of the total traffic using the street.

The use of the motor truck has been criticised on the ground that it increases congestion in city streets. The chief cause of congestion, however, is not the trucks, but passenger vehicles and the failure to recognise modern traffic trends and make adequate provision for them.

Data in the writer's file show that truck traffic on the average amounts to around 15% of total traffic (truck traffic check had not been made by the City Planning Commission). Assuming this to be true of Queen Street, the effect of added traffic resulting from a new Pier 15 would be comparatively small, for it would amount to an increase only of the 15% now represented by trucks. Of this amount only a fraction would be truck traffic to and from Pier 15, and a still smaller amount would be *additional* traffic resulting from a new and enlarged Pier 15. Most of the truck traffic which the writer observed on Queen Street was through traffic between points within the city or the country, or traffic to and from other piers.

If we assumed that the present traffic to and from the present Pier is 15% of *all* traffic, then by assuming that the traffic would increase by the same percentage that the shed area at Pier 15 was to be increased, the *added* truck traffic would amount to less than 3% of all traffic on Queen Street. This would hardly justify widening Queen Street or any of the other measures suggested for relieving traffic congestion. The justification was in the needs of passenger vehicles and all other vehicles which used the street.

Another consideration was that the writer's observations indicated that most of the truck traffic to and from Pier 15 moved during the period of least traffic on Queen Street, while during the periods of greatest congestion the traffic consisted possibly of 90% passenger vehicles.

A further consideration was that a water front street such as Queen Street should certainly be used first as a street for water-front traffic and that of business located on the street, and secondly, for other traffic, particularly through traffic.

Pier 15 Near Centre of Haul of Truck Deliveries

Analysis of cargo movements to and from the pier showed that the Pier 15 location is nearer the centre of haul for inbound freight than any other point on the water front. Discharge of more cargo there will both shorten hauls, lighten traffic, and eliminate much of the traffic which makes for to-day's congestion.

Whether located at Pier 15 or at the present site of Pier 7, cargo movements from a new terminal will have to follow Queen Street to a large degree because of the location of warehouses and other consignees. If the former location is nearer the centre of haul, nearer the warehouses, and adequately provided with parking space, it will create the lessert traffic problem.

Another consideration in selecting the Pier 15 site was that here was the only property owned by the Territory which was accessible to rail facilities, which are desirable as long as the present situation with respect to the continuance of railroad service continues.

Navigation Considerations

The problem of navigation of vessels to and from the various possible sites was studied, particularly because some interests raised this point with considerable vigour when objecting to the Pier 15 site. The writer and other experienced steamship men of his organisation failed to see any point to the objection raised.

Many ships have docked at the present Pier 15 without difficulty. Good pilots and ships' officers would take a ship to any place in Honolulu Harbour where there is enough water to float her. The writer has seen ships docked and undocked at many worse places than any in Honolulu.

Details of Terminal Design Related to Cargo Handling

The next step by the writer was to work with the Harbour Commission and Castle and Cooke, Ltd., agents for the Matson Line, with reference to specific recommendations to details of design in so far as they effected cargo handling.

While all design features of a marine terminal, including the structural features, affect the operation in some way, emphasis must be given to those having a more direct effect on efficient operation, especially cargo handling, if maximum economy is to be obtained.

Port Planning and Terminal Design—continued

Guard Against Obsolescence

Some terminals have actually been obsolete in certain operating particulars the day they were completed, due to lack of thoroughness in studying requirements for the most economical handling of cargo and the prompt dispatch of ships.

Too many terminals are designed without the assistance of men who have had a broad contact with and an understanding of all the operating problems involved. Yet often the opinions of men in charge of a terminal are accepted as a sound basis on which to design. Individual opinions should, of course, be carefully analysed and checked. In one instance, the study of the problem concerning the number of ship-side tracks included discussion with the terminal manager. His opinion of the requirements of stevedores and shipping companies was accepted. As a result, when the terminal was put in service, it was admitted that a mistake had been made, that two ship-side tracks should have been provided instead of the one ship-side track recommended by the terminal manager.

This mistake would have been avoided if a thorough comparative study of track facilities on terminals had been made.

A Terminal Must be Designed for Economical Cargo Handling Operations

While structural design is important from the operating standpoint, in so far as it affects the terminal usefulness, security, efficiency, and costs of operating and maintenance, the function of a terminal is primarily economy in cargo handling and prompt dispatch of ships.

The most direct effects on the costs of transportation are obviously those of cargo handling facilities, and therefore the most consideration should be given to this part of the subject.

The writer wishes to emphasise the fact that, in order to be properly effective, the marine terminal must be designed for operation as a part of the whole transportation system and with all of its functions in view, rather than as a pier or wharf, the design of which is based on tradition (or in other words, copied from previous pier or wharf designs).

In the past 12 years the writer has made extensive studies, alone and in collaboration with others, of terminal design from this point of view.

The data collected was utilised in the discussions at Honolulu on details of terminal design. There is no need to consider preliminary studies and discussions. What will interest you will be the details of design as they now stand after many months of thought, discussion and correspondence.

Details of Design for Proposed Terminal

The overall length of the proposed terminal is 1,290-ft. and the overall width, 270.5-ft. The shed is 1,265-ft. long and 241-ft. wide, containing 305,497 sq. ft. The picture on previous page shows how the new terminal would look from the air.

Cargo masts on terminals are found frequently in New York and other eastern ports, but there are none in Honolulu or other Hawaiian ports.

The lack of cargo masts in some ports seems to be due to a tendency to follow a traditional method, a resistance to new ideas which do not originate at home.

The progressive Castle and Cooke organisations in Honolulu have, through the travels of staff members and the writer's reports, been convinced of the value of the cargo mast.

Their recommendations have been accepted by the Harbour Board, and cargo masts are provided in the design of the new terminal.

Aprons

The plans provide for an apron 29-ft. wide to provide for double tracks of narrow gauge and to allow ample space for operation of tractor trailer trains and other mechanical equipment.

The writer, basing upon many bitter and costly experiences with narrow pier aprons, would rather see an apron too wide than too narrow.

The string-piece will be flush with the deck as it should be on all terminals. A raised string-piece on a modern terminal interferes with handling of cargo to and from lighters or barges, when cargo is worked through side-ports, or even when it is hoisted over all, from a narrow apron.

Decks

Decks, ramps, elevators, doors, and other structural features should be designed primarily with the economical operation of tractors and trailers, portable cranes, and lift and fork trucks in view rather than structural and maintenance costs.

A good deck may be defined as one which offers low starting and rolling resistance to the movement of a truck. From this point of view an absolutely perfect trucking surface is a clean steel sheet. New concrete floors with hardened surface are equal for all practical purposes. Steel sheets are not advocated for all floors but experience shows that their use may often be advisable for gangways, where the major part of trucking is done. On the new Western Maryland marine terminal at Baltimore, steel gangways are provided alongside the depressed tracks that extend down the centre of the piers. These gangways offer a perfect trucking surface for hand movement of trailers, when making or breaking up trailer trains, and also facilitate movement of trains by tractors and the movements of other cargo handling equipment.

Tentatively, it is planned to use 2-in. asphalt on a concrete base for the Honolulu terminal.

Shed Doors

Shed doors are important from the point of view of economical cargo handling, particularly as to their spacing, ease of opening and closing, and protection afforded cargo from the weather.

The writer recommended that doors be provided along the whole length of the offshore side of shed. This arrangement makes docking of ships with hatches in proper relation to doors comparatively easy and shortens the trucking distances in handling freight to and from ships.

Continuous doors were also recommended along the inshore side of the terminal to facilitate loading and unloading trucks outside the shed.

Whether or not these recommendations will be finally incorporated in the design, depends upon the money appropriated by the legislature.

Doors should be durable and of a type not interfering with cargo in opening and closing, should be easily operated, and at the floor should have proper provision to lead water away from the interior.

The lip where the door meets the deck of the wharf, which interferes with trucking of cargo on many terminals, should be avoided. It is a constant source of annoyance, and delays handling of cargo.

The writer recommended use of a recess in the deck to receive a flange on the lower part of the door. This gives protection against water entering the shed. Additional protection is provided by openings in steel plates sunk into the deck just outside the door, which drain water away.

Track Layout

Marginal tracks should preferably be double or triple (space and other conditions warranting and permitting) with enough crossovers to permit spotting or removing cars at any berth without stopping operations at other berths. An ideal, though not always practical track arrangement, is having cross-overs between berths and one at the middle of each berth so that cars can be switched at one end of the ship without disturbing cars at the other end of the ship.

The plans for the proposed terminal at Honolulu provide double cross-overs between berths.

Large openings along the inner side of the rails of pier tracks often cause slowing down of trucking operations, with consequent increased stevedoring cost and damage to cargo which is jarred from trucks or trailers.

Data available indicate that these delays increase cost by a considerable sum. In a test conducted by our organisation for a client, it was found that trucking on a straight-away as compared with trucking across tracks increases speed on the average more than 500%. On one day a fork truck took 90 seconds to cross two tracks, due to the fact that the opening was so wide that the load

Port Planning and Terminal Design—continued

was jarred from the pallet and the truck had to be stopped while the load was being replaced.

By applying the average loss of time due to the above condition to total tonnage handled, it was estimated that this track condition was costing the client over $20,000 a year. Of course, actually the cost was less than this because all tonnage was not trucked across tracks and because sometimes delay due to floor conditions does not increase cost, because it only means less delay of the sling load at ship's side waiting for the hook.

In our judgment, however, the condition described actually cost the client between $5,000 and $10,000 a year.

Experience shows that such a condition can be effectively corrected only by replacing the concrete or other durable material along the inner side of the rails, leaving only a 2-in. opening for the wheel flange on straight track and a 2¼-in. opening on curves.

The expense of this construction work on an old terminal is justified by the savings effected by the stevedore, but if it should be necessary to do something less than replace all concrete or other material along the inner side of the rails, it would greatly improve operations if this is done only for every alternate bay.

In addition, all unnecessary openings around switches should be eliminated.

In this connection, the writer was interested in the statement of an engineer to the effect that he had never thought that such openings made any difference in cargo handling.

More attention to actual cargo handling rather than speculations as to what actually happens would prevent details of design such as track openings which are a tax on cargo handled during the life of the terminal.

Terminal cranes

No consideration was given at Honolulu to terminal cranes because pier studies had convinced the writer that they are not needed except for handling of special cargoes, like sulphur and heavy pieces of cargo exceeding the capacity of the ship's heavy lift gear, or floating derricks.

A well-managed cargo handling operation on a terminal designed for economical cargo handling, utilising pallets, fork trucks, tractors and trailers, and portable cranes, can obtain lower costs than a European operation with its forest of cranes.

Basis of the Honolulu Survey

The whole problem of port planning and terminal design at Honolulu was approached with the minimum of opinion and the maximum of facts, for one man's opinions are *not* " as good as those of another "; they are only as good as his facts.

The features of design were based upon studies to determine the one best type of design, not simply a better design than terminals already constructed in Honolulu. In any case this can be accomplished only by having a sound point of view and by using correct methods of solving problems. Piecemeal ideas and traditional design must not be allowed to influence decisions.

Every reasonable effort must be made to obtain complete data on how other people have designed terminals to meet particular problems. The men who are going to use the terminal and men who are using terminals elsewhere can be interviewed to advantage, providing the interviewing is done by a man who can sift the information given him to determine the facts.

Opinions are worth while only when facts are lacking, and obtaining facts requires checking and double checking by men who are familiar with both the problems of terminal designers and of men who operate a terminal.

Remarkable Cargo Handling Operation.

A notable and extraordinary case of ship discharge under conditions of extreme danger and difficulty is recorded in the press, in a statement giving details of the salvage of a cargo of the value of nearly 3 millions sterling, after the ship had been wrecked on the Australian Coast and broken into two detached portions. Discharge was carried out by barges and lighters working in heavy seas which swept the decks and pounded the wreck. The forward half of the vessel has since been floated into deep water and now lies in an Australian port.

Legal Notes

Responsibility of Wharf Owners for Defective Berth

The responsibility of wharfowners for the defective condition of the berthage alongside a wharf was the subject of a recent action in a District Court at New York, when the Manhattan Corporation, owners of the lighter *Biltmore* sued the City of New York and the Moore-McCormack Line, owners of the steamer *Brazil*, claiming compensation for damages arising out of the sinking of the lighter by sitting on a submerged pile at Pier No. 32, New York, on October 30th, 1940.

As recorded in a report on the action given in *Lloyd's List*, the facts were that the *Brazil* had unloaded barrels of pickled beef on to the pier and that her owners then engaged the *Biltmore* to come to Pier 32 to take these barrels on board. When nearly fully loaded the lighter began to leak, and she subsequently sank with her cargo; and it was found that, in loading, her bottom planks had been pierced by a submerged pile. The owners of the *Brazil* contended that Pier 32 at the time of and for a long time before the accident was a public pier owned and maintained by the City of New York, and that only in the event of actual notice of the defective condition of the berth, or circumstances which would reasonably put the shipowners on enquiry, could they be held responsible. They said that the City of New York had absolute and exclusive control and in fact removed the pile afterwards. On the other hand, the City of New York claimed that for about a year before the accident, the shipowners had exclusive use of the pier and that therefore anything defective making the berth unsafe was the responsibility of the shipowners.

District Judge Inch, giving judgment, said that, during the nine months previous to the accident, the shipowners had asked for and were granted 55 temporary wharfage permits, each limited to a definite vessel and for a definite purpose, but negotiations had started under which the shipowners sought exclusive possession of the pier. It was necessary first, however, for considerable repair and construction work to be done, and the shipowners asked the City of New York for a broad survey of the pier and slips to ascertain the extent of the work. That survey did not take place until after the accident, and in the meantime the City of New York had commenced the work necessary to get the pier and slips in proper shape. During that time the City of New York remained the wharfingers, and from time to time they charged the shipowners wharfage. Shortly after the accident, the work was completed, and exclusive possession was temporarily given to the shipowners in the form of a revocable permit. Later, a five-year lease was granted. In the Judge's opinion, the effort of the City of New York to give retroactive effect to such arrangements was unavailing to change the relationship of wharfinger and permittee. On the question whether the City of New York had exercised due care, the Judge said that ordinary care and inspection would have indicated the danger, and before granting a permit to the shipowners to unload and berth a lighter, some notice should have been given to them that that section had not been repaired and might be unsafe. No notice was given, and the City of New York was therefore liable. There was also a duty of care on the shipowners, but in the Judge's opinion there was insufficient proof that they also were negligent. They were reasonably justified, in the absence of actual notice, or facts calling for their own investigation, in relying upon the good reputation of the berth and the fact that they had been granted, without any notice of danger, a wharfinger's permit for the berthing of their vessels.

The City of New York was accordingly solely liable.

Developments at Spanish Ports.

At Bilbao, in the North of Spain, the port fabric and equipment are undergoing extensive repairs following the damage inflicted during the Civil War of 1936-39, and the Mola Bridge in the port area is being re-erected. The fishery harbour is to be enlarged. The Port of Vigo is also to be improved.

Centenary of Portland, Oregon, U.S.A.

(Concluded from page 152)

River Transportation

Portland and Astoria, as well as intermediate points on the lower Columbia River, are served by freight steamers operating on a regular schedule. On the Upper Columbia, tow boats and barges serve points 200 miles above Portland—carrying largely petroleum products to the interior returning with wheat for the terminal elevators in the harbour. No river services are now in operation on the Willamette River above Portland.

Airways

Portland is connected with mid-Western, Eastern and Pacific Coast centres by the North-west Airlines and the United Air Lines, both operating from the Portland-Columbia Airport.

Unloading Wheat Barge.

The Port of Portland Commission operates two air ports:

(a) Swan Island Air Port, covering 253 acres bordering the Willamette River, is used for local aviators, transients and student training.

(b) Portland-Columbia Air Port is located near the the Columbia River at N.E. 47th Avenue and Bridgeton Road. This modern air port has four 4,000 to 5,000-ft. runways, 150 to 200-ft. wide. Both the United Air Lines and the North-west Air Lines use this air port and maintain permanent facilities there. This air port is also to be occupied by the Air Corps of the U.S. Army as soon as the cantonment, now under construction, is ready for occupancy.

The United Air Lines will shortly increase its South-bound schedule from four to five main liners daily, and there will be eight daily flights to Seattle. Two sleepers and one day plane will make up the Eastbound flight schedule. It is noteworthy that while passenger air traffic has continued to expand rapidly, the air express business has also shown an extraordinary increase in recent months.

The North-west Air Lines has two flights operating out of Portland daily to Chicago, with stops at Yakima and Spokane; Helena and Billings, Minneapolis and other cities, and spur lines to Winnipeg and Duluth. The company has applied for permission to extend its service from Chicago to New York via Windsor, Ontario, and Niagara Falls. It has also applied for a 2,520-mile extension from Minneapolis and St. Paul to Fairbanks, Alaska, with stops at Regina, Edmonton, Grand Prairie and Whitehorse, thus opening a new route between the United States and Alaska.

Obituary

Mr. S. W. Vinberg

The Swedish press records the death on September 15th, of **Mr. Salomon W. Vinberg,** manager of the Stockholm Harbour Board, who was preparing for voluntary retirement on February 1st next.

Mr. Vinberg was born at Hallsberg, in Sweden, in January, 1877, and after completing his education at the Stockholm Technical College, he obtained a position with the Stockholm City authorities, being engaged on harbour construction works. In 1908 he transferred to the Government Waterways Office, and after a period with the Waterfalls Administration and as chief engineer to the Canal Commission he was appointed port director at Stockholm in 1922. He had previously acted as secretary of the Free Port Committee, and had been a member of the Stockholm Council since 1917.

In an obituary notice, the "Svensk Sjöfartstidning," states that he threw his whole life and soul into the task of converting the city's widespread waterways into a modern harbour. He realised from the first the port's possibilities as serving an extensive and rich hinterland, and was largely responsible for the development of the free harbour. As an example of the difficulties he encountered, it is recalled that the proposal to install cranes on the Skeppsbron, the quay in the centre of the city's frontage to the Baltic, was strongly opposed by the Beauty Committee and others. "This city will die of beauty," Mr. Vinberg is reported to have said. The cranes were installed. The development of the Port of Stockholm in the last 20 years is largely attributed to Mr. Vinberg's energy.

The Institute of Transport

A new edition of the **Institute of Transport Handbook** has been issued. This edition contains a note upon the foundation of the Institute and reproduces extracts from a letter, written in 1919, by the late Sir George Gibb, in which he discussed the functions and sphere of the proposed Institute of Transport. Also included are the principal rules of the reconstituted local sections, and a note upon the examinations intimating that certain changes, to be effective as from October 1st, 1943, are in contemplation. The changes comprise the substitution of Modern Economic History for Languages and Mathematics, and of English for Essay in the Graduateship examination. In the Associate Membership examinations it is proposed to provide alternative papers in Rights and Duties of Transport Undertakings, viz., Inland Carriage and Ocean Carriage, to re-model the syllabus (and probably amend the title) of Transport Finance and Accounting and to omit Advanced Statistics. The usual particulars of objects, qualifications for membership, examination regulations and syllabuses are included. Copies of the Handbook may be obtained from the Secretary of the Institute.

Extra Pay for Coal Trimmers.

Coal trimmers at certain Scottish docks have now been given an extra payment to cover "wet" work involved in shipping coal. This extra payment has followed some weeks of negotiation in which the men's Union insisted on their right to extra payment for trimming cargoes when these are very wet. The grant has been conceded by the shipping agents and exporters whose cargoes are being handled. It was contended by them that payment ought only to be made for the actual work of trimming on the actual cargo whether trimmed in practice or not. An alternative contention was that the wet coal should be left to drain until it was dry, thereby eliminating the source of their complaint, but as this would involve delay to vessels it was turned down and the payment allowed.

Notes of the Month

New French Fishing Port.

A Paris Radio announcement quoted by Reuter's Agency is to the effect that a large fishing port is to be constructed on the French coastline between La Pallice and La Rochelle.

Transfer of Port of Beira.

On July 19th last, the official transfer took place of the administration of the Port of Beira from the Charter Company, the Companhia de Mocambique, to the National Government of Portugal.

Wellington Harbour Board Staff Changes.

After 43 years' service, Mr. E. D. Cachemaille has retired from the position of chief engineer to the Wellington Harbour Board, New Zealand, and Mr. K. J. Jensen has been appointed acting chief engineer.

New Port of Liverpool Hostel.

A large mansion at Noctorum, Cheshire, formerly the residence of Sir John Gray Hill, the shipping magnate, is being converted into a hostel for the accommodation of Indian seamen staying in the Port of Liverpool. It will be under the control of a number of shipping companies whose vessels use the Port of Liverpool.

The Institute of Transport.

It is announced by the Institute of Transport that the following have been appointed Hon. Corresponding Members for the areas named. Northern Ireland: Mr. M. J. Watkins, M.Inst.T., General Manager, Belfast Harbour Board. Southern Area: Mr. E. Burrow, M.Inst.T., Assistant to Docks and Marine Manager, Southern Railway, Southampton.

L.N.E.R. Port Staff Changes.

Captain James Anderson, hitherto harbour master at Silloth, has been appointed harbour master at Methil Docks, the important coal shipping port on the Firth of Forth, on the retirement of Capt. Thomas Drever. Capt. Wm. Patterson, deputy harbour master at Methil, succeeds Capt. Anderson at Silloth and Capt. John N. Armour becomes deputy at Methil. The docks in question belong to the London and North Eastern Railway.

New Port in Portuguese East Africa.

It is reported that plans and estimates have been officially approved for the construction of the new Port of Nacala, some 30 miles North of Lumbo, which lies to the South of Mozambique. Nacola is stated to possess a fine natural harbour where vessels drawing up to 18-ft. can anchor within 200 yards of the shore. At one time the place was suggested as the site for the capital of the Mozambique Territory.

New York Foreign Trade Zone.

The United States Commerce Department has received a report on the operation of the New York Free Port, or Foreign Trade Zone, showing that the zone made a profit last year of $233,570.

Merseyside Club for Chinese Seamen.

A club room for Chinese seamen, described as a Chinese seamen's welfare centre, has been opened in Liverpool to meet the needs of a floating population of 2,000 Chinese at the port. The club will accommodate 400. It is the first of its kind in Liverpool.

New Docks in South Africa.

On his return from a visit to England, Mr. F. C. Sturrock, South African Minister of Railways and Harbours, has announced, in Pretoria, the intention of the Union Government to construct a new graving dock, approximately 680-ft. in length, at East London, and a floating dock of 16,000 tons lifting capacity at Durban.

New Chairman of Dry Dock Company.

The directors of the Mercantile Dry Dock Co., Ltd., Jarrow, announce with regret that owing to pressure of business and acting on medical advice, Alderman R. S. Dalgliesh has found it necessary to retire from the chairmanship, though he will continue to remain on the Board. He is succeeded as chairman by Mr. F. Cresswell Pyman, who has been a member since 1931.

Retirement of Aberdeen Harbour Engineer.

After 39 years of service at Aberdeen and 50 years of professional work, Mr Hugh Ritchie Barr, Assoc.M.Inst.C.E., has retired from the harbour engineership at Aberdeen. Lord Provost Mitchell at a recent meeting of the Harbour Board expressed the great regret of the Commissioners at his relinquishment of the post. Mr. Barr has been succeeded by Mr. John Anderson, Assoc.M.Inst.C.E., who took up his duties on October 1st.

Visit of the Food Minister to London Dock Canteens.

Lord Woolton, Minister of Food, recently paid a visit of inspection to three of the nine dockside canteens in operation by the Port of London Authority. He was accompanied by the Rt. Hon. Thos. Wiles, Chairman of the Port of London Authority, Sir Douglas Ritchie, general manager and other port officials.

The canteens form part of a programme of 12 being provided by the Port Authority. They have a seating capacity for 2,500, capable of expansion to 4,000 at short notice. The cost of the scheme is £50,000. Hot mid-day meals for dock workers are cooked on the premises, or distributed from central kitchens. These canteens replace the many eating houses close to the docks which were destroyed in the air raids of 1940.